THE BULLETIN

of the

AMERICAN ASSOCIATION

of

NURSE ANESTHETISTS

FEBRUARY

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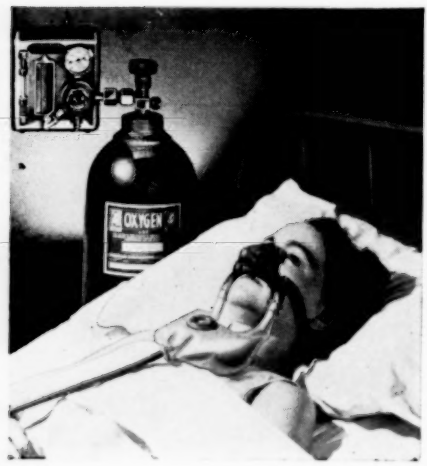
VOLUME 8 NUMBER 1

PURITAN MASK AND BAG



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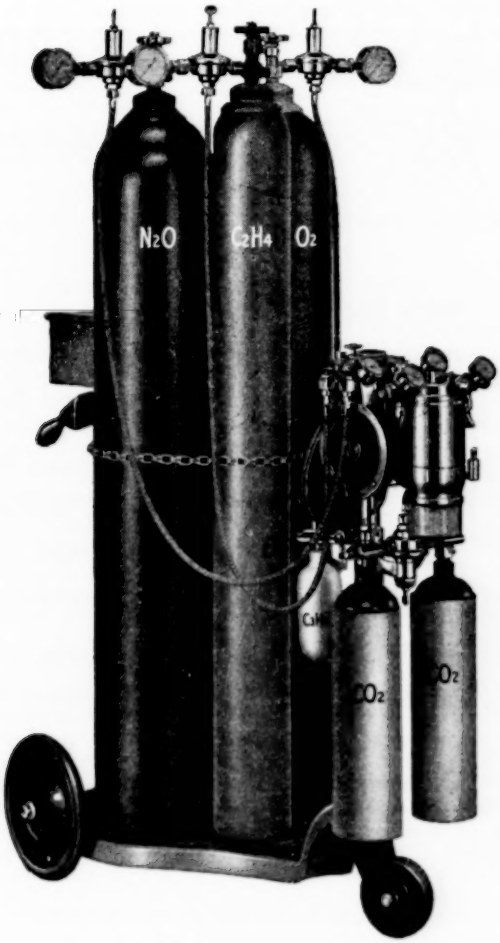

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BULLETIN OF THE AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

The Bulletin of the American Association of Nurse Anesthetists is published by the American Association of Nurse Anesthetists; Executive, Editorial and Business Offices, 2065 Adelbert Road, Cleveland, Ohio.

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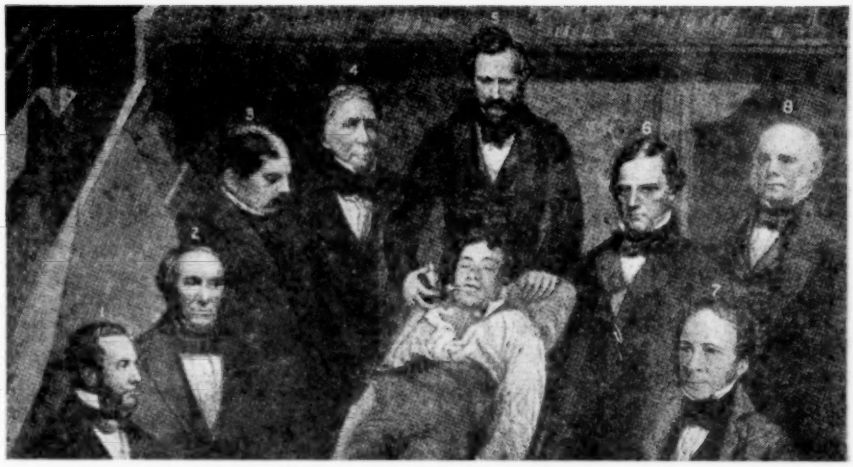

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FIRST PUBLIC DEMONSTRATION OF ETHER AT THE MASSACHUSETTS GENERAL HOSPITAL, OCTOBER 16, 1846

1. Dr. Henry J. Bigelow; 2. Dr. Augustus A. Gould; 3. Dr. J. Mason Warren; 4. Dr. John C. Warren; 5. Dr. William T. G. Morton; 6. Dr. Samuel Parkman; 7. Dr. George Hayward; 8. Dr. T. D. Townsend

BOSTON — THE NEXT CONVENTION CITY

Our Annual Convention is to be held in Boston this year, for the first time; and, doubtless, many will be thrilled with the prospect of this opportunity to see the birthplace of Surgical Anesthesia. For, despite the controversy that raged so bitterly and is still occasionally aired, Boston alone can proudly show the original room and apparatus used for the first authentic demonstration of controllable painless surgery; the reports of which, submitted by the eminent medical men of Boston, finally convinced the world of the greatest advance in medicine ever made in America, rivalling in significance the later contributions of Pasteur and Lister.

The momentous event happened less than 100 years ago. The story is well-known to all of us. As we look around the room of the beautiful old Bulfinch building of the Massachusetts General Hospital, we can picture the tense little group of Boston's foremost doctors, dressed in the conventional frockcoat of the period, assembled on that morning of October 16, 1846, to witness the preposterous claim of a young dentist that he could demonstrate this miracle of insensibility to pain. The simple comment of the surgeon at the close of the operation: "Gentlemen, this is no humbug!" is significant of the scepticism of the group.

Dr. John Collins Warren was then nearly seventy years of age; one of the founders of the "M.G.H."; Professor of Surgery at Harvard. No doubt he was familiar with the ineffectual druggings, hypnotism, and empirical

treatments in general, that so great a need had called into practice through the ages. We can imagine his deep satisfaction that his open-mindedness had hastened the fulfilment of the quest for this priceless blessing of insensibility to pain.

Crude as that first ether anesthesia must have been from present day standards, its value was irrefragable; and full honor was accorded to the anesthetist, William T. G. Morton, by the sponsors of the demonstration, whose unquestioned ability and integrity gave emphasis to the importance of the event. Through the subsequent years of ignominious controversy and financial disappointment which Morton had to endure, these men remained his staunch supporters, while the world, though profiting by his discovery, was slow in according him honor. In keeping with a too common custom, this did not come in full measure until after his death. However, it is recorded that he gave ether to over two thousand soldiers during the Civil War; and in a letter to a friend, at the time, he wrote in touching terms of his spiritual reward in having been the instrument for bringing surcease of pain, during necessary surgical operations, to the many wounded heroes who then fought for their Country;" substantiating that "It is more blessed to give than to receive."

The word "Anesthesia" was suggested by Dr. Oliver Wendell Holmes—the poet—in a congratulatory letter to Morton, when he emphasized the importance of the choice of a suitably dignified name for the discovery, with the prophecy that it would "be repeated by the tongues of every civilized race of mankind."

The monument erected to the memory of Dr. Morton in Mount Auburn Cemetery bears the inscription written by Dr. Jacob Bigelow: "William T. G. Morton, Inventor and Revealer of Anesthetic Inhalation. Born, August 9, 1819. Died, July 15, 1868. By whom pain in surgery was averted and annulled. Before whom in all time surgery was agony. Since whom Science has Control of Pain."

Boston has a most distinguished history in medical achievement since the founding of Harvard College in 1636, when the medical needs of the community were usually attended to by what Cotton Mather described as the Angelical-conjunction of minister-physician, by one of whom the first medical paper to be published in America was written. Inoculation for smallpox by Zabdiel Boylston, an apprentice physician, in 1721 called for much personal bravery and force of conviction in face of the ignorance and superstition of the populace; but his persistence finally gave to him credit for defeat of one of the most deadly scourges of the early settlers. In this history of those times, other innovations follow in quick succession making fascinating reading. The Warren Museum of Harvard Medical School, in the Fenway, Boston, contains most interesting and illuminating exhibits of the local progress of Medicine.

Harvard Medical School was founded in 1782 to fill the need for more scientific training in medicine, and many are her famous sons who have contributed in large measure to the well-being of humanity. Outstanding among those of the 19th century are Dr. Jacob Bigelow for his work on "Self-limited Diseases," and Dr. Oliver Wendell Holmes who convinced America that Puerperal Fever was contagious and preventable.

Boston vies with Philadelphia and New York in long hospital tradition of high standing; the Massachusetts General Hospital was founded in 1811, and the Boston Lying-In Hospital in 1832. Throughout their history the wards of these hospitals have provided a good proportion of the clinical opportunities necessary for the furtherance of notable medical innovations. As a city Boston ranks among the largest in America, and still retains much of its early charm and refinement while keeping abreast of the world in cultural and scientific achievements. The City and surrounding country-side abound in places of historic interest and beauty. Apart from the stimulating attractions of the Convention in particular, I am confident that our Society will feel generously entertained during the visit to Boston.

ALICE M. HUNT, R.N.

New Haven Hospital
New Haven, Connecticut

NOTICE

Plans are well under way for the program of the eighth annual meeting of the American Association of Nurse Anesthetists, which will be held in Boston, Mass., September 16-20, 1940. New England, with its emphasis on educational pursuits and accomplishments, and its progressive and cultural atmosphere, makes the East a most attractive section of the country in which to hold a meeting of this nature. The anesthetists in New England will be responsible largely for seeing that the traditional New England spirit and charm are exemplified to our group at the coming convention, and are asked to communicate with the Executive Secretary, indicating their desire to cooperate in making this meeting an outstanding event in the history of the American Association of Nurse Anesthetists. We want those who are visiting the East for the first time to leave the meeting with a keen realization of the impressive historical background of the city in which the first public demonstration of the administration of ether was held. Let the spirit of Morton and his contribution to anesthesia inspire us to make the 1940 convention a long forward step in the development of our organization.

With the constant development of new methods and technics in the administration of anesthetics, we are confident that many members of the American Association of Nurse Anesthetists all over this country, by virtue of their practical experience and the wealth of opportunities afforded in the institutions in which they are employed, must have a worth while contribution to make to the program.

If there is any particular subject you wish discussed, or if you have a paper of interest you would like to present, may we hear from you at an early date. Kindly send all contributions and suggestions not later than April 1, 1940, to Miss Anna Willenborg, Executive Secretary, 18 East Division Street, Chicago, Ill. Your interest, your ideas and your cooperation will make this a successful meeting.

PHYSIOLOGY OF ANESTHESIA

JAMES GRAHAM, M.D.
Attending Surgeon and Consulting Anesthetist
St. John's Hospital, Springfield, Illinois

Read at the seventh annual meeting of the American Association of Nurse Anesthetists, held in Toronto, Canada, September 26-29, 1939.

During the past decade the science of anesthesiology has developed at a more rapid rate than perhaps any other branch in the surgical field. The administration of anesthetic agents has become so specialized and so technical that the surgeon knows less about the practical administration of the agent than does the anesthetist. This rapid technical development has given rise to a new field of specialists and technicians, and with the rise of the specialty the surgeon has lost his dominance of the field of anesthesiology. The anesthetist is no longer the trampled serf of the "ether days"; she is a technician in a highly specialized field, carrying a major responsibility.

During this period of great development in anesthesiology, with consequent delegation of more and more responsibility to anesthetists, the surgeon, who by training has a broad background of physiology, has become less intimately connected with the practical application of increasingly potent anesthetic gases and medications, while the anesthetist, whose physiological background is not so broad, has become more and more intimately connected with the use of these powerful agents. At times the changed relationship may reach an unwarranted extreme of specialization; the surgeon may not know what anesthetic agent is being used in a particular situation.

It is time for the surgeon to exhibit more concern for the problems arising in the administration of anesthetic agents and it is time for the nurse anesthetist to rise to the increasing responsibilities of her profession by a studious application to the problems of physiology that bear upon the introduction of potent gases and drugs into the body. The problems arising between surgeon and anesthetist will find readier solution when the surgeon shows a greater concern for anesthesia and when the anesthetist displays a keener interest in, and a greater hunger for knowledge, of the physiological distortions she is creating in the patient by the induction of anesthesia. The common meeting ground is missed so often because the lack of the surgeon's interest in anesthesiological problems has not aroused his physiological sense and because the anesthetist's lack of interest in physiological problems has not aroused the surgeon's practical sense.

I would like to discuss three commonly recurring problems that can be brought to ready and extremely beneficial conclusions when the surgeon and the anesthetist meet each other half way on a physiological basis. These are three "bugbears of anesthesia": (1) the speedy induction, (2) the rigid abdominal wall, and (3) inadequate preoperative medication.

Speedy Induction

Anesthesia cannot be carried to the third stage speedily. The term surgical anesthesia implies that stage of anesthesia at which major surgical procedures can be effected with constant maintenance of the degree of anesthesia for a reasonable length of time. The second and third planes of third stage anesthesia can be attained speedily but they cannot be maintained until a

rather definite length of time has elapsed. Sufficient time must elapse to allow for the establishment of an equilibrium between the gas tension in the face piece of the machine and the gas tension in the body tissues.

Professor Guedel of the University of Southern California has demonstrated conclusively the manner in which the regulation of inhalation anesthesia is governed by the laws of diffusion of gases and vapors. The stations of importance along the diffusion route are: (1) the alveolar air, (2) the alveolar membrane, (3) the blood, (4) the tissue cells. Diffusion is always in the direction of lessening partial pressure.

At the beginning of induction, the gradient of partial gas pressure is from the alveolar air to the tissue cells. At this stage, when the partial pressure of the anesthetic gas in the alveolar air is high, and partial pressure in the tissues is low, the diffusion from face piece and alveolar air to tissues is rapid. With the deepening of anesthesia, and elevation of partial pressure in the tissues, rapidity of diffusion is decreased. When the state of near-equilibrium of gases is reached throughout the body, partial pressures are so nearly equalized that diffusion almost ceases. As anesthesia is lessened, with emptying of anesthetic gas from the alveolar air and face piece, partial pressure of the gas within the cells is higher, the gradient is reversed, and gas flows from the tissues toward the lungs.

Since the circulation of blood to the brain is much more abundant than to other tissues, particularly fat tissue, an anesthetic gas, diffusing from the alveolar air, will reach the brain first. Therefore, the partial pressure of anesthetic gas in the brain cells will reach a percentage consistent with anesthesia even before the fat tissues have taken on any gas. There is established a diffusion gradient from the brain to other organs with a less abundant circulation. If a heavy flow of gas is maintained in the machine, diffusion is in the direction of alveolar air to brain and to organs of less volume of circulation, and from brain to these organs. If flow in the machine is decreased, there is diffusion from the brain to the alveolar air and to the organs of lesser circulation. It is quite obvious, then, that in order to hold brain saturation, a heavy flow must be maintained until all of the body tissues have become saturated. The gradient of diffusion, from alveolar air to the tissues, or the reverse, is altered by the partial pressure of the anesthetic gas in the mask. When a particular plane of anesthesia is maintained, partial pressure of the gas in the alveolar air and in the tissues is practically at equilibrium, the gradient being directed toward the mask, or toward the tissues, as partial pressure in the mask is decreased or increased.

The time interval required for the establishment of an equilibrium of pressures in the mask and in the tissues is best illustrated by setting up two periods of saturation: (1) saturation of brain tissue and (2) saturation of other organs.

All of the blood of the body passes through the lungs in a few seconds over one minute. In a period of just five minutes only four complete circulations of the blood have occurred. Guedel estimates that all of the blood must pass through the lungs twice in the presence of a full anesthetic tension of the faster-acting agents, such as cyclopropane, before even a near-saturation of the blood may be expected. If two more complete circulations are allowed for diffusion of gas from the blood to the brain, the time required for brain saturation is five minutes. If the full anesthetic tension is maintained for another five minutes, time is allowed for saturation of the remaining organs and tissues.

In teaching at St. John's Hospital we set an arbitrary period of five minutes for stabilization of anesthesia in the particular plane desired. We use the charted directions of Guedel for passing to and from the various planes of third stage anesthesia. We believe the designation of these planes to be a very valuable adjunct to the safe administration of anesthetic gases, but if the directions are followed at all, they must be followed with deliberation. The reason for this is that every time the partial pressure of gas in the mask is altered, the gradient of diffusion is altered, or reversed, and a new equilibrium must be established between tissues and alveolar air.

This brief survey of the problems concerned in the diffusion of gases during inhalation anesthesia should demonstrate rather pointedly that a period of approximately fifteen minutes is required for the induction of inhalation anesthesia with stabilization in the desired plane. This is the minimum time required when using the very readily diffusible gases, such as cyclopropane. The surgeon who asks for good third stage anesthesia in a period of time less than fifteen minutes is asking for something that does not follow good physiological principles.

The Rigid Abdominal Wall

The second "bugbear" that frequently responds very pleasantly to a friendly physiological discussion between surgeon and anesthetist is muscular rigidity that appears during abdominal operations. Sometimes, it is the anesthetist who is at fault; sometimes, it is the operating room staff; sometimes, the surgeon; sometimes, the patient. Always, the anesthetist is blamed.

Obstructed respiration is a common cause of abdominal rigidity, and in this situation the anesthetist is distinctly at fault. When the air passageway is obstructed, the tidal volume of respired air is decreased and a proper flow of anesthetic gas from the mask is not maintained. In addition, the anoxemia resulting from an obstructed airway causes rigidity directly.

When the operative procedure is commenced before the skin reflexes have been abolished, rigidity is the result. The flood of sensory impulses to the cord and to the higher centers gives rise to tetanic muscular contractions. It is common experience among anesthetists that a longer time will be required for reaching third stage anesthesia when the second stage is violent. Thus, premature commencement of the operation brings about muscular rigidity and prolongs the second stage of anesthesia. Only the anesthetist should decide when the patient is ready for operation, that is, when the desired plane has been reached. Two methods that are commonly used for determining the arrival of the proper degree of anesthesia are without good physiological foundation. The first of these consists of sticking the patient with a scalpel to see whether he jumps and the second is that of palpation to determine whether the muscle is soft. The sticking method only serves to initiate more reflex contractions, and the second method is unreliable for the reason that muscular flaccidity may supervene during the early stage of brain saturation, only to give way to rigidity a few minutes later. Overstimulation during the second stage rarely may cause ventricular fibrillation with a fatal termination.

The operating room staff is at fault when the patient is not properly positioned on the table. This really is an apparent rigidity resulting from muscular stretching. The patient's position should be checked carefully during operations on the gall bladder, on the kidney and on the female pelvic organs.

Muscular rigidity may be occasioned by the actual trauma of operative procedures, and in such instances the surgeon may do a great deal to improve the situation by the supplemental use of local anesthesia.

Dr. George Crile's investigations have thrown considerable light on the nature of rigidity caused by the pain of the first incision and the subsequent rigidity arising from reflex stimulation, such as manipulative procedures about the upper abdominal and the pelvic organs, in which instances the large sympathetic plexuses are pulled and traumatized.

Crile maintains that anesthesia does not prevent the flow of afferent pain impulses to the cord and brain but that it interferes with the motor power of muscles that are active normally in the execution of reflex movements. When pain stimuli from an incision are set up before the motor half of the reflex arc has been obliterated in anesthesia, the muscles will contract, with the production of rigidity. Since anesthesia does not obliterate painful stimuli, the shock that would follow an operation without anesthesia likewise follows an operation with anesthesia. In the latter case, the memory of pain is lost. Shock is very noticeably increased during an operation under anesthesia when large nerve trunks are manipulated. In such situations, when satisfactory anesthesia has been maintained previously in the upper planes of the third stage, reflex-motor responses will appear and rigidity will be present. Such occurrences can be prevented by deeper anesthesia. Local infiltration of sympathetic ganglia will likewise prevent such rigidity. However, more careful handling of tissues by the surgeon is the safer and more effective method. In operations that do not require any unusual traction on organs, the area of greatest pain stimulation is the abdominal wall, particularly the peritoneum. Local infiltration of the abdominal wall, supplementing the inhalation anesthetic agent, will prevent rigidity in the upper planes of third stage anesthesia. At St. John's Hospital, we have found this technic quite satisfactory and very pleasing and comforting to the anesthetist.

These observations are merely suggestions, that may be investigated in more detail with great benefit. There are many causes for rigidity of the abdominal musculature during anesthesia. The true cause in each instance will be revealed by the application of known physiological facts. Once the cause is determined, the offending element may be corrected. The anesthetist is responsible for some forms of abdominal rigidity, and she must also be mindful of all forms, in order that she may better substantiate her own position.

Inadequate Preoperative Medication

This is classed as a "bugbear" because it may be responsible for many difficulties encountered during the administration of anesthetic agents. In institutions employing nurse anesthetists, preoperative medication is in the hands of the surgical staff, but the staff of anesthetists should be consulted from time to time in order that the advantages and disadvantages of particular routines may be measured properly. Uniformity of preoperative medication should be the ultimate aim of the staff so that the anesthetists may become intimately familiar with a few types of medication. The anesthetist who must work with the individually varying preoperative routines of a dozen or more surgeons is under a distinct handicap.

The ideal condition of a patient prepared for anesthesia is that in which metabolism approximates as closely as possible the basal metabolic level for

that individual. Certain factors tend to raise metabolic rate and all such factors must be taken into consideration when medication is ordered. Elevation of metabolic rate increases the requirement for the anesthetic agent. Generally speaking, there is a tendency to underestimate the amount of sedative required by infants and to overestimate the amount required by elderly individuals. Proportionately, the basal metabolic rate of infants makes a sharp rise during the first year of life. The level increases steadily but somewhat less abruptly to the age of five, and levels off fairly evenly to about the prepuberty era. During adolescence there is another rather steep rise. After adult life has been attained, there is a slow but steady decline.

For every degree of fever there is a rise of approximately 7 per cent in the metabolic rate. Pain, emotional excitement, worry and fear increase metabolic activity and sedative requirement. Toxemias associated with continued sepsis likewise raise metabolic rate. A very effective influence in allaying preoperative fear and excitement is a visit to the patient in his room by the anesthetist. A brief visit for a few friendly words and a short inquiry into the previous anesthesia and operative history of the patient creates confidence in the anesthetist and frequently brings to light helpful information.

Drugs used for preoperative medication vary with the individual and the institution, but far more important than the particular type of drug are the dosage and the time of administration. No rule can be laid down for dosage because this varies entirely with the individual. The common error in administering drugs preoperatively is giving them too late. The medication must have time to exert its maximum effect before anesthesia is begun. Barbiturates should be given from two to four hours before operation and in addition a smaller dose should be given before bedtime on the previous night. Morphine, when given subcutaneously, reaches its maximum effect in from sixty to ninety minutes; when given intravenously, in about twenty minutes. Paraldehyde may be given intravenously to alcoholics and it exerts a maximum effect in about ten minutes.

Definite routines can be established for the time of administration of drugs and particular types of drugs, but the dosage must vary with the individual. For an adult of thirty years, weighing approximately 160 pounds, and of average stature and average mental composure, we, at St. John's Hospital, would use approximately the following medication for an elective abdominal operation: Nembutal, grains 1½, at 9:00 p.m.; nembutal, grains 3, at 4:30 a.m.; nembutal, grain ⅙, scopolamine, grain 1/250, at 7:00 a.m.; operation 8:00 a.m. Cyclopropane is used most commonly in this institution. In hospitals employing nurse anesthetists, an effort should be made to standardize the types of drugs used and the time of administration. The anesthetist is working under a distinct handicap when the varying routines of many surgeons are employed. Adequate dosage at proper time intervals is essential.

Let the anesthetist enlarge upon these brief observations on the practical application of the physiology of anesthesia. An increasing responsibility is being placed upon her and she must meet this responsibility with studious application. She has many problems that must be discussed with the surgeon, and the surgeon's interest in those problems will be aroused to greater heights when he finds that the anesthetist is making a serious and intelligent effort to solve them.

RESUSCITATION IN THE OPERATING ROOM

FREDERICK R. MAUTZ, M.D.

From the Department of Surgery of the University Hospitals and the Western Reserve University School of Medicine

Read at the seventh annual meeting of the National Association of Nurse Anesthetists, held in Toronto, Canada, September 26-29, 1939.

Acute failure of vital physiological processes in the patient subjected to operation is a problem that continues to face the operating room personnel. Although better preoperative preparation of patients and improvements in the choice and administration of anesthetics have greatly reduced the risk of surgical procedures, sudden death in the operating room is not rare. Of course we have no accurate registry of these accidents, but I think you will agree that if we knew the number of these accidents, let us say for the continent of North America, the figure would be quite impressive. Each year those of us in clinics where large numbers of operations are performed see several persons die in the operating room as a result of acute cardiorespiratory failure. The ratio is perhaps one such event to each 3,000 to 5,000 operations. It is quite true that many of these "accidents" are in patients with little chance of recovery, but there is a group in which these unfavorable conditions do not exist and the processes are reversible providing we have the means to cope with the temporary situation.

The subject of resuscitation is not new, and I am sure many of you have had successful experiences in what appeared desperate situations. Our interest in a further study of this problem began in connection with the work in our Laboratory of Surgical Research, where Dr. Claude S. Beck, Dr. John J. Thornton and I were engaged in studying problems of surgery of the heart. In our experimental operations respiratory failure due to medullary paralysis was never a problem because we used artificial respiration consisting of an intermittent insufflation of compressed air and ether. However, we did have many fatalities due to heart failure, principally because of the onset of ventricular fibrillation but occasionally due to cardiac dilatation and ventricular standstill. Ventricular fibrillation was invariably fatal. Prevost and Battelli as long ago as 1899 had shown that if the fibrillating ventricles were given an electric shock, sometimes the fibrillations would stop and a coordinated heart beat would be resumed.[1] Hooker and his associates in Baltimore studied this method and advised using an alternating current of about 1.5 amperes applied for a half second, to be followed by the central carotid injection of calcium chloride and adrenalin and with cardiac massage to strengthen the coordinated beats when such a condition was again obtained.[2] Wiggers of Cleveland emphasized the importance of cardiac massage preceding the electric shock to first bring oxygenated blood to the myocardium.[3]

We attempted to use this method in our Surgical Laboratory but found that we could not restore a coordinated heart beat in more than half of our cases. Later we learned that novocaine was a myocardial depressant as well as a nerve depressant and we found that those cases of ventricular fibrillation which would not respond to an electric shock would do so after the injection of novocaine into the blood stream, preferably through the wall of the

right ventricle.[4, 5] Concentrations of novocaine 5 per cent and higher applied to the surface of the heart produce a reduction of surface irritability of the heart as well as being absorbed into the blood stream and affecting the entire myocardium. When the heart becomes flabby and dilated after the injection of novocaine, we use calcium chloride and adrenalin to increase the tone and augment the contractions.

I wish now to discuss some clinical cases in which resuscitative measures were used. Mrs. Gertrude Fife has collaborated in this work and any degree of success that we have had has been largely due to the close cooperation of the anesthesia department.

Our first attempt to use this method in the operating room was in a boy of twenty on whom Dr. Beck was going to operate for cardiac compression due to an injury to the heart. The patient was a very poor operative risk and came to the operating room cyanotic and with a poor circulation. During the induction stage of a nitrous oxide-ether anesthesia the patient suddenly became pulseless and stopped breathing. The chest was quickly prepared and the heart exposed. The heart was seen to be markedly dilated, cyanotic and the seat of ventricular fibrillation. The heart was massaged, given an electric shock with large electrodes in contact with the ventricle, with the result that a feeble coordinated beat was restored. The vigor of the beat did not improve and the cyanosis persisted. Oxygen was administered through the face mask under a constant pressure, plus compression of the chest. Obviously we did not succeed in bringing oxygenated blood to the myocardium and this prevented at least a temporary restoration of the circulation. Autopsy showed mural thrombosis involving both ventricles and extensive pulmonary infarcts of such a degree as to be hardly compatible with recovery, but nevertheless a temporary restoration of the circulation should have been possible. The lesson we learned from this case was the necessity of a reliable method of pulmonary ventilation for such cases—such as we have been accustomed to use in our Surgical Laboratory for experimental studies.

We then had a unit built for use in the operating room, incorporating a mechanical respirator and shocking device so that everything would be in readiness should the occasion arise. We have had considerable experience with this respirator. This is merely an arrangement for the intratracheal injection of compressed air or pure oxygen, to which ether vapor may be added. Following are descriptions of two cases in which we used the respirator:

Case 1. A right pneumonectomy was done on a patient with carcinoma of the lung, under cyclopropane-ether anesthesia. The patient developed acute cardio-respiratory failure following the clamping of the hilar structures and became cyanotic and pulseless. A tracheal catheter was in place and the respirator described was attached; the patient was given mechanical insufflation of pure oxygen, with prompt restoration of good color and a good circulation. The patient later resumed spontaneous breathing and was returned to the division in good condition. This patient died ten days later of an empyema. In this case the heart was still beating sufficiently at the time the respirator was started to maintain some circulation of blood through the remaining lung and the circulation improved as soon as the alveolar oxygen tension was restored to normal by the respirator. The respiratory center recovered as soon as a good circulation was reestablished.

Case 2. A man with a large brain tumor developed respiratory paralysis upon being placed on the operating table in the cerebellar position. The

respiratory rate was only two per minute, of a gasping type, and the patient was cyanotic. The patient was placed in the Drinker respirator for one and one-half hours, at the end of which time respirations remained the same. An intratracheal catheter was introduced, and the patient was given artificial respiration with the mechanical respirator during the time that a craniotomy was performed and a large meningioma was completely removed. Postoperatively the patient's respirations returned to normal and convalescence from the operation was uneventful. It is now two years since the operation and the patient is living and well.

This was a case of respiratory paralysis due to increased intracranial pressure. After relief of the intracranial pressure, respirations returned to normal. There can be no reasonable doubt that the respirator saved this man's life. We have had several other similar cases of complete respiratory failure that recovered from the acute condition following a period of artificial respiration.

We found several disadvantages to the respirator that I previously described and that we used in this case. Considerable time must elapse in changing over from the usual anesthesia equipment. With this respirator an intratracheal catheter must be inserted, which causes some delay in starting artificial respiration when early signs of respiratory failure develop.

For this reason we worked with the idea of having a mechanical respirator as an integral part of the closed system anesthesia equipment.[6] In the discussion of studies of artificial respiration that have been made, it is generally agreed that mouth to mouth insufflation of the lungs is superior to any of the other methods so far as replacing the alveolar gas of the lung.[7, 8] Exactly the same thing can be accomplished by having a tight fitting face mask and exerting rhythmic manual pressure on the rebreathing bag, which can be flooded with oxygen. This certainly is the procedure of choice for handling cases of acute respiratory paralysis. The manual method is difficult to keep up for a long period of time and the pressure fluctuation cannot be precisely controlled. We constructed an apparatus to carry out this procedure. (Figure 1).

The rebreathing bag is surrounded by a rigid container and the bag can be rhythmically compressed by injecting air into the space between the bag and the rigid container. As long as the escape valve is open there is no interference with the patient's respirations but this can be closed in a fraction of a second and the artificial respiration started. This we believe is a very important point, since the greatest single obstacle to successful resuscitation is the delay in getting adequate artificial pulmonary ventilation. No tracheal catheter is necessary in the absence of obstruction of the air passage.

The closest we have come to a successful resuscitation from ventricular fibrillation was in the following case:

A 13 year old colored boy had a plastic operation on the eye. Nitrous oxide-oxygen-ether anesthesia was used. There was considerable mucus in the respiratory passages during the operation, but otherwise his condition seemed fairly good throughout the operation. Just as the operation was being completed respirations suddenly ceased; four minutes later the pulse became imperceptible. There was considerable delay in starting resuscitative measures due to the fact that the operation was not performed on our main operating floor. Forty-three minutes after cessation of respirations the patient was started on mechanical respirations using our respirator at-

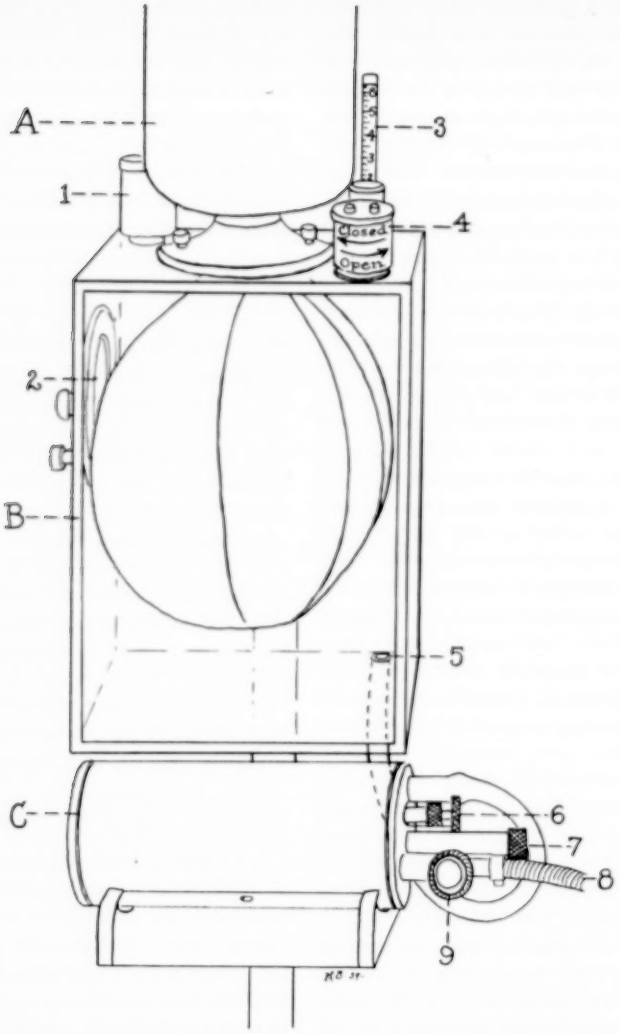

Fig. 1—Diagram of the mechanical respirator attachment for a closed system anesthesia machine. *A* is the soda lime canister of a Heidbrink machine. *B* is the rigid container surrounding the rebreathing bag. *C* is the injector for the intermittent insufflation of compressed air into *B*. When valve 4 is open, the action of the respirator is completely eliminated, since there is a free escape of air from the space surrounding the rebreathing bag. When valve 4 is closed, the rebreathing bag is rhythmically compressed, the rate and volume being regulated by valves 6 and 9 and the lung-bag pressure fluctuations indicated by the manometer 3. A safety valve 1 prevents the development of excessive pressures.

tachment to the anesthesia machine and the heart was exposed. The heart was in a standstill. After a short period of massage there were a few feeble beats, following which ventricular fibrillation developed. An electric shock was unsuccessful in stopping the fibrillation. After the use of procaine, adrenalin and calcium chloride the electric shock restored a coordinated beat. The heart was kept under observation for thirty minutes, during which time the circulation remained good and the chest wound was closed. The pulse remained good for an additional three hours and then the circulation again failed. No sign of recovery of the central nervous system was seen during this period of time.

In a second case a boy of 14 was subjected to a minor surgical procedure under nitrous oxide-oxygen-ether anesthesia. The patient was in light anesthesia during the entire procedure; the color and condition were good throughout. The patient's pulse suddenly became very irregular and arrhythmical and then became imperceptible, followed shortly by respiratory failure. The patient was started on mechanical respirations. The heart was exposed and was found to be the seat of ventricular fibrillation. The heart beat was restored with massage, drugs and electric shock. The circulation remained good for about one and one-half hours and then failed a second time. In this case the acute disturbance was primarily cardiac, and by inference it seems that in this patient a ventricular tachycardia developed which was transformed into ventricular fibrillation.

In both of these cases the period of cerebral anoxemia was too long to expect recovery, but shortening this period of time is only a technical problem of organizing a resuscitation plan that can be put into effect the instant an accident occurs. Such obstacles are surmountable.

We have confined the discussion of the use of a mechanical respirator to cases that require resuscitation. We do not advocate the use of such a respirator when there is no definite evidence of respiratory insufficiency, but we do advocate its use when there are *early* signs of respiratory failure. This respirator may be of particular value in intrathoracic operations, since it will enable the surgeon to produce bilateral pneumothorax without the slightest danger of acute respiratory insufficiency. We have used the respirator in a number of thoracic operations in which one or both pleural cavities were opened and have found it quite satisfactory to ventilate the collapsed lung. With the problem of emergency artificial respiration solved, we believe surgeons will begin to report successful resuscitations from ventricular fibrillation. So far as we know there has never been a successful recovery in a human being from an established ventricular fibrillation.

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ETHYL CHLORIDE

HORACE M. MILLER, A.B., D.M.D.

2136 N. E. 8th Ave., Portland, Oregon

Dentistry gave to the world ether and nitrous oxide, and they have stood the test of time. Today the dental profession is proving clinically the value of ethyl chloride for the extraction of teeth in children.

History

It has been a long time since Florens in 1847 conceived the idea of ethyl chloride, and Heyfelder in 1848 began using it clinically. In 1880 the British Medical Society decided that ethyl chloride was too dangerous to human life for use as an anesthetic. The manufacturers of ethyl chloride were having difficulty in producing and purifying it, and its limitations and physiological action were not understood. Today many men unfamiliar with its use condemn it, and in order to present its limitations and advantages let me summarize its present use in dentistry.

The increasing number of tonsil operations performed today under general anesthesia, and particularly under ether, has brought about the increased use of ethyl chloride in sequence with ether. The fact that it shortens the induction stage and eliminates the period of active cough reflex common with ether were factors in bringing about its

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popularity. C. H. Robinson, Clinical Demonstrator of Anesthetics at the University of Toronto, says, "Ethyl chloride is a safe drug when properly employed. It has no equal as a preliminary to ether."

Since 1895 the following reports of the successful administration of ethyl chloride have been published:

		No. of Cases
Theising and Soullier	Lyons, France	8.417
Martin Ware	Good Samaritan Dispensary, New York	1.000*
Queens Hospital	London	30.000§
Great Ormond Hospital	London	40.000
R. Smith, D.D.S.	Arkana	1.402¶
Feldman	New York	60.000
J. A. Green		3.500‡

* (personally administered)
§ (10-year period)
¶ (to 1937)
‡ (patients 9 months to 15 years)

In 1915 the Forsyth Dental Clinic in Boston started using ethyl chloride and Jacobs reports to date over 200,000 consecutive successful administrations, using it routinely for children's extractions with no special attention paid to

whether or not the patient has had a recent meal.

In the dental clinic at North Pacific College, Portland, Oregon, we use ethyl chloride for extractions on children from 2 to 14 years, and occasionally up to 20 years of age. Children tolerate ethyl chloride much better than local anesthesia. For extensive extractions, impactions or resections we use nitrous oxide and oxygen routinely because it allows a longer operating time. During the past seven years I have administered or instructed students in the administration of over fifteen hundred consecutive ethyl chloride anesthesias without any bad reaction, masseteric spasm or necessity for artificial respiration.

Ethyl chloride has been associated closely with somnoform and before ethyl chloride was used extensively somnoform was the choice for short general anesthesia. When a face mask, bag and ampule holder were used its action was rapid, anesthesia being established on the fourth or fifth deep inhalation. This was due chiefly to the ethyl chloride contained in it, as the early somnoform ampules contained 35 per cent ethyl chloride, 60 per cent methyl chloride, and five per cent ethyl bromide. Today the label states the contents as 83 per cent ethyl chloride, 16 per cent methyl chloride and 1 per cent ethyl bromide. I used somnoform for about six years before changing to ethyl chloride. The American Dental Association committee reported that they would not accept somnoform purchased on the open market because they could not obtain definite quantities of ethyl bromide in their tests. In view of the fact that their tests disclosed that the contents were not according to label, and because of the adverse criticism which might result if fatalities occurred under somnoform, I changed to the accepted ethyl chloride and actually obtained equal if not better results. Ethyl chloride is free of ethyl bromide with its high toxic reaction. Gwathmey prefers ethyl chloride to nitrous oxide and oxygen for children, and Herrenknecht places its safety above nitrous oxide and oxygen. Many anesthetists have found nitrous oxide and oxygen a poor agent for children with a few teeth to be extracted or for short operations.

With the improved methods of manufacture and purification ethyl chloride is increasing in popularity. It is preferred for children from 2 to 14 years of age, where one to six simple extractions are to be made and when up to three minutes operating time is desired. The face and head may be free of operating equipment because the mask or gauze used in administering the anesthetic can be discarded as soon as anesthesia is obtained. It is not a maintenance anesthetic, as patients are not carried into a prolonged or deep anesthetic state and it is not expected to take the place of nitrous oxide and oxygen anesthesia. It is useful if children are frightened by a hypodermic needle or extensive anesthetic equipment, and particularly if the child has had previous bad experiences, the use of ethyl chloride on a few folds of gauze held over the mouth and nose is a big help.

Cost

The anesthetic is inexpensive. There is no initial outlay for complicated equipment, and it can be used wherever there is a dental chair, as the 100-gram glass containers can be carried around with ease in any dentist's handbag. Ordinarily a simple glass container of the 100-gram size costs $1.00 but in gross lots about 45 cents each. Metal containers cost up to $1.50 each. Ten to twenty administrations can be obtained per container, making the cost from 4½ to 8 cents for each administration.

A local anesthetic made from novocain pellets costs $1.00 per bottle of one hundred or when purchased in quantities of a dozen bottles costs usually $10.00, making the cost of a 2 per cent solution about 1 cent per cc., or from 4 to 6 cents for the extractions. Ampules cost from $5.00 to $7.50 per hundred in the 2 cc. size, consequently compared with local anesthetics ethyl chloride is on an even basis and costs much less per administration than nitrous oxide and oxygen.

Properties

Ethyl chloride is a colorless, mobile liquid, exceedingly volatile, with a sweetish taste and a pungent odor. It is inflammable but not as inflammable as divinyl oxide, and burns with a greenish-edged flame. It decomposes under heat and light and therefore must be stored in a cool, dark place and preferably always returned to its cardboard container. Its boiling point is 12.5° C., with a specific gravity of 0.92138 at 0° and 0.951 at 12° C. Its vapor density is 2.22 and it is soluble in ethyl ether or ethyl alcohol. Water will dissolve 1/50 of its weight of ethyl chloride. Ethyl chloride will dissolve phosphorus, sulphur, oils, fats and many resins. It combines readily with many metallic chlorides and must be stored in tightly stoppered bottles or containers. Full or almost completely full bottles of ethyl chloride expand sufficienty to break when slightly heated, consequently the practice of submerging a bottle in warm or hot water to volatilize the liquid must be done carefully to prevent breakage.

Metal containers while strong do not permit observation of the contents and one does not always know when it is almost empty. When made of glass modern containers of the standard or syphon type permit the anesthetist to see how much liquid is left, and are equipped with a fine or coarse spray, the valve being of a simple open and closed type.

E. R. Schmidt in the American Journal of Surgery, December, 1936, states: "There are only five 100 per cent anesthetic agents—ether, chloroform, ethyl chloride, vinyl oxide and cyclopropane." He points out that ethyl chloride will abolish all response to stimuli including activity of the respiratory center.

Ethyl chloride diminishes the secretions of the liver and kidney. It deepens and quickens the respiration, and during normal administration very little ethyl chloride is taken up by the blood stream. Some believe that anesthesia is produced as a result of peripheral dilation of blood vessels, causing a cerebral anemia. I have observed, however, that while most patients have the flushed face and body caused by a dilation of the peripheral vessels, there are many who do not exhibit this phenomenon, so probably it cannot be the entire cause. In the February, 1937, issue of Surgical Clinics of North America William Bronower states, "Ethyl chloride and cyclopropane are cardiac depressants and one must evacuate the bowels and bladder before administration." Some patients do not develop complete muscular relaxation under ethyl chloride but most authorities place ethyl chloride as normally giving more muscular relaxation than nitrous oxide and oxygen. The so-called "masseteric spasm" which some anesthetists report accompanies a high concentration of the drug and in patients with a susceptibility to ethyl chloride, and as a preventive the mouth should be propped open with a small spool or prop, the anesthetist always having a wedge at hand to force access to the throat. In fact it is best to keep the mouth prop in position during palinesthesia until the patient recovers to cooperative consciousness. Many careful anesthetists

giving short administrations report never experiencing this phenomenon and I consider it as an infrequent occurrence.

Embly reports the paralytic action of ethyl chloride on heart muscle but explains that it takes nineteen times as great a volume of ethyl chloride as of chloroform to produce comparable results. Webster, experimenting on animals, reports that small doses of ethyl chloride produce a slight rise in blood pressure which returns to normal, and that large doses cause a rise, then a return to normal followed by a rapid fall. Herrenknecht reports that he has never had to resort to artificial respiration or stimulation with camphor or other drugs in over three thousand cases.

Some authorities condemn repeated administrations of ethyl chloride, particularly if the desired number of teeth are not removed. In several instances I have repeated the administrations, starting it before the patient fully recovered, and I have observed no undesirable results, and many other anesthetists report the same result. Herrenknecht pointed out that ethyl chloride is not adapted to long anesthesias, due to its high efficiency and ability to produce rapid narcosis, and to the fact that the lethal dose could easily be surpassed. Animal experiments with ethyl chloride show that respiration stops usually before the heart action ceases. The U. S. P. gives the total dose as 10 to 15 cc. but this is hard to determine and the dose could be mistaken easily. The vapor tension of the inspired air is an important factor. We do not have the signs of cyanosis or pallor with ethyl chloride as with chloroform or with nitrous oxide and oxygen, consequently one must be careful in regard to possible overdosage. In some hospitals where surgery is performed on other parts of the body than the mouth, an ordinary chloroform mask is placed over the face of the patient and ethyl chloride administered drop by drop or sprayed on the gauze and kept up for thirty to forty minutes, so there can be no serious objection to its administration in dentistry from thirty to sixty seconds by the following method: removing the mask, extracting one to six baby teeth, replacing the mask, administering additional ethyl chloride for twenty to forty seconds and finishing the operation of elevating a broken root or extracting additional teeth. If this is deemed inadvisable the anesthesia can be repeated at another sitting a few days later.

Milne after operating on six hundred patients reports three hundred done by the closed and three hundred by the open method, and advocates the open method. Dr. L. N. Ellsworth, of Salt Lake City, in a clinic at the Pacific Coast Dental Conference, stated that he had tried almost every type of mask including several of his own design and favors the open method without mask. I prefer to use several layers of gauze about 5 by 5 inches square, held over the nose and cupped at the mouth, with the mouth propped open. As I spray the ethyl chloride on the gauze I gradually close off the nose by pinching the gauze over it with my left hand. This helps to stabilize the head in one position and I hold the ethyl chloride container in my right hand about 12 to 16 inches away from the patient's face. Ethyl chloride is a refrigerant and evaporating cools the surface, and it can be used topically freezing the tissue around loose baby teeth, allowing painless extractions or the lancing of abscesses. If the container is held too closely to the face, the spray drives through the gauze, striking the tender parts of the mouth and causing the patient to flinch, withdraw or assume a defensive attitude.

Holding the container away from the face reduces the force of the spray and less of the drug is wasted. Vaseline used on the lips before placing the gauze prevents the tissue from sticking to the gauze. If ethyl chloride drips from the gauze it indicates that too much anesthetic is being used. Too fine a spray may not produce anesthesia, consequently all new containers should be tested, and used ones inspected for clogged or poor openings.

Routine

A typical case: child 4 years old; spoiled, nervous. I advise no food before the operation, and this information is given the parent when the appointment is made. One to two teaspoonfuls of elixir of phenobarbital is given thirty minutes before the operation and the patient is allowed to recline in the recovery room in absolute quiet. The bladder and bowels are evacuated just before the little patient is placed in the dental chair, which is tilted slightly back to prevent sliding. The patient is restrained in the chair if nitrous oxide and oxygen is used but with ethyl chloride there is no suggestion of restraint. The nurse or assistant places the towel over the protecting rubber, and the patient's *chin must be well up*. Better cooperation is obtained if the patient is asked to blow the anesthetic away, and this is demonstrated to him. The assistant is behind the chair with her hands over the rubber apron ready to restrain or catch the child's arms if he starts to struggle, but no suggestion or hint is given in advance of this intention. The assistant informs the dentist when muscular relaxation occurs, although he observes the eye reflexes, breathing and general muscular tone, and as with any general anesthetic every respiration must be either seen, heard or felt and the patient's condition followed closely. Some children hold their breath and if this occurs the assistant gently but forcefully induces inspiration by pressure on the diaphragm. In about fifty seconds the patient is ready for operation. The gauze on which the ethyl chloride was sprayed can be used as a throat pack, excluding air and preventing particles of broken tooth from being aspirated. After extraction the throat pack is removed immediately and a few whiffs of aromatic spirits of ammonia is administered on the corner of the towel which is around the patient's neck, and the patient's head is tilted forward to allow saliva and blood to drain. Swallowing blood produces nausea. Within a few minutes the average patient can get up and walk out of the office unassisted. Some patients perspire freely and if this happens or if the patient is nauseated I insist that he remain in the recovery room ten to thirty minutes to prevent catching cold and to allow for recovery from shock. If peripheral dilation has occurred the patient should not be dismissed until normal color returns. Ninety per cent of the patients will be out of the office within fifteen minutes.

Case report:

A normal boy ten years old was admitted for extraction. He knows me, has had ethyl chloride before and likes it. It was 4:30 p.m. and the patient had had no food since 11:00 a.m. No premedication was given and the bladder was evacuated. The patient sat in the chair and inhaled deeply and I played the ethyl chloride spray on gauze until he appeared to have barely lost reflexes. The extraction was performed under analgesia more than anesthesia. Aromatic spirits of amonia was given and the total time from consciousness to consciousness was one minute flat. The patient was not aware of the work being done and was uncertain as to just what had happened as everything occurred so quickly.

PENTOTHAL SODIUM

KATHLEEN STURGEON

University Hospital, Ann Arbor, Michigan

Read at the second anniversary meeting of the Michigan Association of Nurse Anesthetists, held in Detroit, Mich., November 11, 1939.

Barbiturates were first used intravenously in 1929—sodium amytal, then sodium pentobarbital or nembutal, and in 1932 evipal sodium was introduced. At that time these drugs were administered in single doses. Pentothal sodium, also termed sodium ethyl thiobarbiturate, thio-pentobarbital or thionembutal, is a relatively recent drug prepared by Volwiler and Tobern. It was introduced clinically by Lundy in 1934, since which time it has been used in that clinic more than 12,500 times. Chemically, pentothal sodium is the sodium salt of ethyl-thiobarbiturate. It is the same as nembutal except that one oxygen atom has been replaced by a sulphur atom, which seems to accelerate its rate of destruction in the body. Pentothal sodium is thirty to fifty per cent more potent than evipal, and less toxic, and it produces better anesthesia for a wider range of cases. It is detoxified rapidly by the liver and recovery is attended by fewer instances of excitement.

Pentothal sodium is prepared in ampoules containing 0.5 gram or 1 gram and is a yellowish powder with a sulphur-like odor. In some clinics a 5 or 10 per cent solution is used but we prefer a 2½ per cent solution, i.e., 1 gram of pentothal sodium dissolved in 40 cc. of sterile distilled water. We use the greater dilution because the anesthesia is more easily controlled, and should any of the solution be injected accidentally into the tissues there is no danger of sloughing.

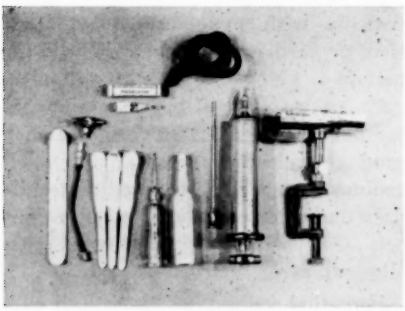

FIG. 1
Equipment

The set-up for intravenous anesthesia:

Syringe, 50 cc.
Syringe, 2 or 5 cc.
Needle, 20 or 22 gauge—1¼ inch
Spinal puncture needle (for mixing the solution)
Flexible adaptor
Two-way stopcock
Tourniquet
Sterile towels
Swabs
Alcohol
Bandage
Small strips of adhesive
Holder for syringe
Arm board
Ampoules of pentothal sodium
Ampoule of picrotoxin—1 cc.
Ampoule of coramine—5 cc.

The patient is prepared as for any general anesthesia. No barbiturates are given for at least twelve hours prior to anesthesia, because they may produce excitement and disturb the control of the anesthetic. Other premedicants may be given to lessen the amount of anesthetic drug required and to produce sleep more readily. Premedication is especially advantage-

ous in long operations, and the following may be used:

Morphine	1/8 grain	One hour preoperatively	10 to 15 yrs.
Atropine	1/350 grain		
Morphine	1/6 grain	One hour preoperatively	15 to 60 yrs.
Atropine	1/200 grain		
Atropine	1/200 grain		Senile and poor risks

In the operating room the patient is made comfortable, the blood pressure apparatus is applied and the initial reading recorded. The gas machine, an airway and the usual equipment are at hand. After the patient has been prepared and draped by the surgeon, the arm is immobilized and a vena puncture is made, using a vein in the antecubital fossa, and 2 to 6 cc. of the solution is injected slowly. The patient is engaged in conversation or asked to count, and when the patient shows signs of anesthesia the surgeon stimulates the skin to determine the depth of anesthesia. The needle is kept in the vein and the pentothal is administered intermittently as necessary. The amount of the drug cannot be judged on the basis of the patient's weight, sex, or metabolic rate, but must be administered according to the individual reaction to the drug; furthermore, the necessary dosage varies slightly with the same patient on different days. With large doses the respiration becomes slow and shallow. An unobstructed airway is of the greatest importance and usually support of the jaw is sufficient, but if necessary an artificial airway may be used. Oxygen must be given as indicated. As the effect of the anesthetic wears off the respiration becomes stimulated and phonations are noted, followed by movements of the extremities.

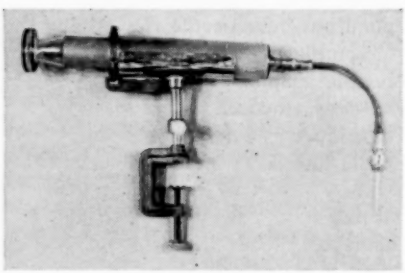

FIG. 2
Holder designed by Dr. Davis

During the anesthesia the pulse, blood pressure and respiration must be watched closely. The pulse rate may increase but usually returns to normal and the blood pressure remains nearly constant. Too rapid or too large doses of the anesthetic cause respiratory failure and for this condition oxygen, artificial respiration and intravenous picrotoxin are administered—picrotoxin being the specific analeptic agent. The cumulative effects may appear suddenly. As the operation continues the required dosage diminishes progressively with each unit of time. Small amounts may be given from time to time to prevent clotting of blood in the needle but in long operations the two-way stopcock with intravenous saline solution is preferable.

Contraindication: We do not recommend that pentothal be used for anesthesias of long duration or for the poor anesthetic risk patient. Pentothal should not be used in the presence of respiratory obstruction, dyspnea, or liver disease, and generally in those patients with hypotension, hypertension, or cardiac decompensation. If the patient is being treated with sulfanilamide, we use evipal because pentothal sodium also contains sulphur and may produce untoward results. Pentothal sodium is not tolerated well by children under ten years of age. The drug acts as a respiratory depressant. Its elimination is retarded in toxemia.

Pentothal sodium has been used with very good results in the following types of operations:

Biopsy
Dilatation and curettage
Radium implantation
Cystoscopy
Transurethral resection
Eye operations or any operation about the face
Cautery of the mouth or face or whenever a nonexplosive anesthetic is necessary
Reduction of fracture
Difficult dressing or examinations
Closure of bronchopleural fistulae
For nervous or apprehensive patients

In this clinic during the past year a 2½ per cent solution of pentothal sodium has been administered approximately one thousand times, and the record of the first eighty-one cases is as follows:

Sex

Male	60
Female	21

Age

ranging from 10 to 80 years

Service:

Thoracic surgery	50
General surgery	25
Urology	6

Type of Induction:

Quiet	75
Long	2
Not recorded	4

Blood pressure variation:

No change		63
Elevation	5-10 %	5
Elevation	10-20 %	2
Depression	5-10 %	5
Depression	10-20 %	2
Not reported		4

Pulse variation:

No change	65
0-10 % rate increase	10
20 % or more rate increase	3
Not reported	3

Duration of anesthesia:

Less than one hour	76
Over one hour	5
Average amount of anesthetic	27 cc.

Type of reaction:

Quiet	75
Excited	2
Euphoric	3
Not reported	1

Reaction time:

10 minutes	53
10-20 minutes	9
20-30 minutes	11
30 minutes-1 hour	4
1-2 hours	2
More than 2 hours	2

Postoperative complications:

Nausea and vomiting	4
Headache	3
No complaints	74

The patient awakens more quickly following the administration of pentothal sodium than from any of the other barbiturates. The rapidity with which

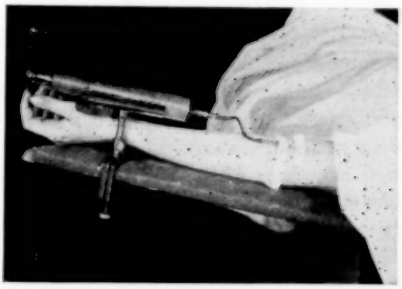

FIG. 3
Syringe clamped in position

consciousness is regained is in direct proportion to the amount of the drug administered. Usually ten to fifteen minutes is sufficient for full recovery, consequently the anesthetic may be discontinued approximately fifteen minutes before the end of the operation. Reaction time may be hastened by the slow intravenous administration of 5 cc. of coramine. The patient with diabetes may show a slight increase in the blood sugar following the anesthesia, but this is more than compensated for by the absence of postoperative vomiting.

Like any anesthetic, pentothal sodi-

um should be used with care, and is not suitable for every case. It is desirable from the patient's standpoint because of the ease of administration, pleasant, brief induction, and the absence of psychic shock. In some clinics it has been used with good results in major operations lasting three to four hours.

It has been stated recently that there is evidence of a cumulative effect which causes damage to the myocardium and liver if repeated injections of pentothal sodium are given. However, these preliminary reports have not as yet been substantiated.

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HELIUM—ITS VALUE IN THERAPEUTICS AND ANESTHESIA

DOROTHY LEE SAGE

Dallas, Texas

Helium was discovered in 1868 by Jannsen and Lockyer while spectroscopic studies of the gases found in the sun were being made, and Ramsey demonstrated its existence on the earth by isolating helium from mineral cleavite. In recent years, helium has been found in some natural gases of American oil fields, and its increasing use in dirigibles and balloons is well known. Helium, on account of its lightness and non-explosive properties, is also valuable in the field of medicine and anesthesia. In 1919 Elihu Thompson suggested its use for divers, to increase the effectiveness of oxygen at the high barometric pressures found at great depths. No toxic effects were reported when helium was used for short periods. Barach, at Columbia University, who was probably the first to use helium therapeutically, published a paper in 1934.

The specific gravity of helium is 0.138. It is chemically inert, and is the lightest of all gases except hydrogen. Hershey reported that the rare atmospheric gases were necessary to life, but this has been disproved by Barach[10] and by Orcutt and Waters.[11] Further comparison of helium with other gases is interesting. A mixture of 79 per cent helium and 21 per cent oxygen has but one-third the weight of an equal quantity of air. Hydrogen has a molecular weight of 2, but of course is too dangerous for clinical use. Helium is next with a molecular weight of 4. Nitrogen and oxygen have molecular weights of 28 and 32 respectively.

The rate of motion of gases is of importance, since strictures or edema of the air passages make the entrance of any gas difficult. The rate of motion of a molecule of hydrogen is 1840 meters per second; helium, 1300 meters per second; nitrogen, 500 meters per second; and oxygen, 460 meters per second. When the bronchioles are closed by edema or spasm it is easier for rapidly moving molecules to be diffused in and out of the alveoli, thus keeping them at a more nearly normal distention.

In order to understand more fully the physiology of gas therapy and the

effects of helium on respiration, the experiments of Barach are of considerable importance.[3] He reproduced mechanically the essential conditions in constricted air passages and found that when obstruction to the flow of air is present in any part of the tubular system, there is immediately developed a necessity for an increase in the pressure required for inspiration and expiration. In one experiment an individual was made to breathe through an orifice one-eighth inch in diameter into a spirometer of the basal metabolism type, in which valves were used to circulate the air through soda lime. A record of the tidal air was obtained and the pressure produced in the extension of the pulmonary airway was recorded by a tube attached 1 inch from the patient's mouth. A comparison between the effect of breathing air and a comparable mixture of helium and oxygen showed that the tidal air was approximately the same in both instances. However, the total pressure developed in the tubal system between inspiration and expiration was 10.2 cm. of water pressure when air was breathed, and 4.6 cm. when the helium-oxygen mixture was inhaled—a reduction of 54.9 per cent. This decrease in the total range of pressure during the respiratory cycle due to the inhalation of a lighter gas mixture is an indirect estimate of the saving of pulmonary effort effected in conditions in which there is obstruction or narrowing in the tubular respiratory system.

The primary factor in the dyspnea produced by obstructed respiration appears to be a physical interference with the flow of air in and out of the lungs at a velocity and pressure to which the individual is accustomed, rather than oxygen-want or carbon dioxide excess. The actual response of patients with asthma and those having obstructions in the larynx or trachea bears out this belief. Patients with chronic, continuous asthma were more frequently relieved of dyspnea with a mixture of 17 to 19 per cent oxygen and 81 to 83 per cent helium than with concentrations above these percentages. The slight anoxemia was without observable ill effects when patients suffering from laryngeal or tracheal obstruction were treated similarly. In these cases there is congestion of the lungs with edema and red corpuscles, which interferes with the normal diffusion of oxygen through the pulmonary membrane. When normal subjects are made to breathe violently, tidal volumes are markedly increased, and increased pressures are present in the pulmonary airways. These pressures are reduced between 30 and 50 per cent by the inhalation of 20 per cent oxygen and 80 per cent helium.

Boothby inhaled a mixture of 70 per cent helium and 30 per cent oxygen for several periods ranging from five to fifteen minutes.[5] The voice became nasal and the pitch was altered due to the change in resonance produced by substituting light molecules of helium for the heavier molecules of nitrogen. A metallic taste in the mouth was noticed, as well as dryness in the upper respiratory passages, and a slight headache. The symptoms disappeared slowly after helium was discontinued, but were so minor that they were not considered contraindications to the use of helium. No serious after-effects from the use of helium have been reported on patients thus far, and mice have been kept in atmospheres of helium and oxygen without apparent injury for periods of ten weeks.

Barach was probably the first to use helium in intractable asthma.[6] Where such patients were refractory to adrenalin, he found that the use of helium-oxygen mixtures restored adrenalin sensitivity and resulted in improve-

ment both subjectively and objectively. Barach, in 1936, reported eighteen cases in which he used this type of therapy, and five of these were of such severity as to suggest fatal outcome. In 1935 he reported one case in which the patient inhaled the helium-oxygen mixture continuously for 24 hours and subsequently for shorter intervals. Maytum and his associates reported that colonic ether anesthesia also breaks the cycle and restores adrenalin sensitivity.[5] However, one patient in a series of 3 cases failed to show response to this type of therapy. Maytum believes that the return of adrenalin sensitivity is not attributable directly to helium but is an accompanying effect. However, the use of helium is to be preferred to colonic ether anesthesia in restoring sensitivity to adrenalin.

The following case report from Methodist Hospital in Fort Worth, Texas, offers additional evidence as to the value of helium in severe asthma. Mrs. D., an asthmatic, age 45 years, was admitted to the hospital with dyspnea, coughing and slight cyanosis. Adrenalin was given every four hours but after four days had afforded no relief. A mixture of 79 per cent helium and 21 per cent oxygen was given for twelve minutes at three different periods. After the first administration the patient's respiration became deeper and easier. After the third administration marked relief was obtained. Two days later the patient became irrational and her condition was critical. The helium-oxygen mixture was again given for fifteen minutes and was repeated thirty minutes later for another fifteen minute period. After the first inhalation, temporary relief only was obtained, but after the second inhalation respiration became deeper and easier. Adrenalin was administered five days later with better results. The patient was discharged seven days later improved.

Barach recommends for adults a mixture of 25 per cent oxygen and 75 per cent helium admitted into a tent at the rate of 4 to 6 liters per minute and for infants, 2 to 3 liters per minute. In status asthmaticus, some patients are relieved in a few minutes; others require two to eight hours treatment to obtain relief. Positive pressure of 0.5 cm. to 4 cm. of water is advantageous in lowering the intrapleural negative pressure. Pressures of 5 to 10 cm. have been used for short periods. If cyanosis is not relieved by a mixture of 80 per cent oxygen and 20 per cent nitrogen, the use of the helium-oxygen mixture is warranted.

The use of the helium-oxygen mixture is indicated for patients with tracheal or laryngeal obstruction, especially when the difficulties are transient. For example: Laryngeal edema following operative trauma; foreign bodies lodged in the respiratory tract; temporary palsy of the vocal cords, which complicates operative procedures on the thyroid gland. If the obstruction is below the site for tracheotomy, dyspnea may be relieved by the helium-oxygen mixture. Other conditions in which the helium-oxygen mixture may be useful are: emphysema, bronchiectasis, and pulmonary fibrosis. The experiments of Barach in a series of twenty cases of cardiac disease illustrate the effect of the helium-oxygen mixture in such conditions.[2] These patients were compensated at rest and dyspneic on exertion. One patient showed a reduction of 26.2 per cent in the total of the inspiratory and expiratory pressures.

Lahey, in discussing a paper by Barach, stated that he considers helium of sufficient importance to have a tank of the gas attached to every anesthetic apparatus in his Clinic.[6] He also states

that the use of helium has saved the lives of three patients during operations for intrathoracic goiter.

While helium itself has no anesthetic properties, it is an important adjunct to anesthesia. Sise, also of the Lahey Clinic, in discussing anesthesia for thyroid surgery, points out that helium is not a substitute for a clear airway but is of decided value in cases of severe obstruction.[7] He uses the helium-oxygen mixture to relieve difficult breathing, and after this is accomplished, begins the administration of cyclopropane. Helium cannot well be used with nitrous oxide or ethylene, since these gases require concentrations of 80 to 90 per cent for anesthetic effect. This leaves barely enough room for the necessary oxygen and no room for helium.

Eversole reports five cases in which partial respiratory paralysis occurred during spinal anesthesia.[9] The helium-oxygen mixture was used and breathing was made easier in all cases. In one case the helium-oxygen mixture was alternated with pure oxygen, and each time the patient reported easier breathing during the administration of helium. Eversole used helium either during the induction or maintenance of anesthesia in 110 cases. Of this group, 87.6 per cent of the patients obtained either complete or partial relief, and 12.4 per cent obtained no relief from stridor or obstruction. When helium was used during emergencies, the insertion of an intratracheal tube was unnecessary in many cases.

While helium cannot be classed with panaceas, it has sufficient value to deserve further study. Accurate case records should be kept by the anesthetist who desires additional evidence. It is fortunate that Congress has made available a sufficient supply of helium for clinical use.

SUMMARY

1. Helium is the lightest non-explosive and non-toxic gas, and its use in both respiratory experiments on normal individuals and on patients with obstructed air passages indicates that it is of considerable value.
2. Experiments by Barach show that total pressures developed during the respiratory cycle are reduced from 30 to 50 per cent by the use of helium-oxygen mixtures.
3. Patients with severe, intractable asthma are afforded relief and a return of sensitivity to adrenalin is accomplished by the use of helium.
4. Patients with tracheal or laryngeal obstructions, foreign bodies in the respiratory tract, respiratory difficulties during thyroid surgery, or with cardiac disease are greatly relieved by the use of helium-oxygen mixtures.
5. Helium is not a substitute for a clear airway, but is of considerable value in emergencies, often making more heroic measures unnecessary.

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TUNE IN ON CHENGTU

West China Union University Hospital, Chengtu, Szechwan, West China

(A Letter from Myra L. Sawyer)

To those of you who have for so many years associated me with the Shantung plains in North China, Szechwan, the largest province in the country, a great inland empire with a population of more than sixty millions, may seem like a distant, unknown country. Take your map of China—the most detailed one you can find, and let me help you find Chengtu. Start at the mouth of the Yangtse River, down at Shanghai. Go on up the river past Nanking, to Kiukiang. A days' trip north from this point is the famed mountain resort of Kuling. Five hours south on the railrod is Nanchang, where I spent 1934-35. Now, back to the river, and on up to Hankow, the "Chicago" of China, this city, with Changsha (Yale-in-China), and Hanchang, forming a triangle. On up the river to Ichang, the entrance to the beautiful Yangtse gorges, from which point, in 1900, Captain Plant took the first commercial steamer up to Chungking. The first main stop after Ichang is Wanhsien, one of the two treaty ports of Szechwan (Chungking being the other). Wanhsien has been bombed several times, as it is the site of an important airdrome. Fifteen hundred miles from the sea, a ten days' journey on the fastest steamers from Shanghai, one arrives at Chungking, the largest city in West China, with a population of over 600,000, and now the seat of the National Government. Following the river, or rather its branches, southwest, you will find Suifu, then swinging around a curve northward you pass Kiating, and on to Chengtu, the capital of Szechwan, with a normal population of some 400,000. The city is situated on a plain, at an elevation of about 1,500 feet, with hills on the far horizon, the nearest some fifty miles away and visible on the clearest days.

This is the route which I would have taken in normal times, to reach my post last winter. But as the Yangtse River was not safe at that time, I proceeded on down the coast from Shanghai to Hongkong, and transhipped there

to a small French steamer bound for Haiphong. From there, via Hanoi, we went up the scenic French railway, through mountain gorges and passes of wondrous beauty, and marvels of engineering skill—past hundreds of miles of lush, soft green paddy fields, picked out with the brilliant yellow of flowering rape, and blossoming fruit trees. The houses were much the same type as elsewhere in the Orient, of stone only where such is plentiful, otherwise of sun dried adobe brick, with thatched straw roof. Our train travelled through Indo-China by day only, so we spent the nights at native inns of sorts, with a measurable degree of comfort. We carried our own meals for train travel, both for cleanliness, and because those served by the Annamese attendant were both expensive and greasy. At the border between Indo-China and Yunnan, for the umpteenth time since I crossed from the United States into Canada enroute for Vancouver, I presented my passport and went through customs. On to the capital of Yunnan, formerly called Yunnanfu, now known as Kunming. Hospitable Mr. Evans of the English Methodist Mission was at the station in answer to my telegram from Hanoi, and steered us through the preliminary formalities. I speak advisedly for I later spent the most of five days at the Consulate, the Bureau of Foreign Affairs, the railroad station, and the Customs Office, before I got my baggage through, a permit from the government for my radio, and a transit pass for my journey into Szechwan. Conditions in the land make travel a thing of much red tape. But I stuck at it, and finally had my permit to travel to Chengtu by bus or plane, as conditions might warrant.

However, the American Consul was unwilling for me to make the journey overland, by precarious conveyances, over awful roads—a ten day trip, and alone. Without his o.k. I could not proceed, so I waited in Kunming thirty-eight days for a plane reservation. The military were of course given precedence, and mere woman had to wait. I was unable to get a direct passage to Chengtu, but had to go via Chungking. It was more expensive, but gave me an appreciated opportunity to see that city, the mission work being done, and have brief visits with Dr. Marion Yang, beloved friend and coworker, and Miss Yu, my former assistant superintendent at Yehchow. Dr. Yang's public health headquarters were wrecked in the recent bombings, but she carries on, and is a valued government employee. This capital city has been bombed sixteen times to date. It is situated on high cliffs, with admirable facilities for dugouts and caves, so while buildings suffer, and nerves are harrowed, there is now little loss of life there during raids. The American hospital has been rendered untenable, but the Canadian plant is still intact. The Generalissimo and wife make their headquarters in the nearby hills. As you will see on your maps, this province is a mountainous district, and by orders all high schools, many of the provincial colleges, business and factory concerns, have moved out of the large cities, to carry on in comparative safety, hidden from the view of the airplanes. This applies to the entire northwest, west and southwest of China, and gives you the picture of rural China carrying on industrially.

My plane trip from Chungking was a joy, quite a different experience from the other longer one from Kunming, when because of inclement weather we flew at an altitude of more than 15,000 feet, and I saw nothing but the thick clouds from the window (and the inside of a paper bag, as I was desper-

ately ill from the motion and lack of oxygen). I was deaf and upset for three days after it. But the next experience restored my faith in air travel. I was met at the airdrome by three members of the University staff with a most cordial welcome. Dean Kilborn took me to his home for breakfast, and then we crossed the main campus to the smaller easterly section across the road where the Methodist buildings are situated, and to my new home with Dr. and Mrs. Liljestrand.

West China University is host to several other colleges at present—Ginling, and Central University of Nanking, and Cheloo Medical, all carrying on a united work as best they can under the existing conditions. The new University Hospital is still in process of construction on the main campus. Chancellor Beach has been months enroute from America, bringing some ten tons of equipment. Alas, while in Chungking in the heat of July, loading this freight on native junks to bring up to Chengtu, he was stricken with a virulent form of dysentery, and was for days at death's door. You may picture our joy that he is now quite out of danger, though very weak.

I have a small but pleasant room at the L's, with a corner of the porch adjoining for a wee private sitting room, where I have my radio, a table desk, and a couple of chairs. Just what the future holds as to residence for me is somewhat uncertain, as our home and the one next door were badly injured in the June bombing. President Ch'en's house was completely demolished, and ours will have to be torn down after the war if a bomb does not do it first. Our doors and windows were mostly blown in or out, glass smashed, my porch wardrobe collapsed; nearly all the ceiling plaster is down, the roof lifted and settled slightly askew, and floors all somewhat aslant—you can picture the remains. We hope to "make do" for the winter, providing there is no further near-by bombing, but that is a matter difficult to predict!

Dr. and Mrs. L. and self had a miraculously narrow escape, as there was no raid signal given on the campus. We had just twenty seconds after we saw the planes to rush into the front hall, before they were upon us. I bent over, covering my face and eyes with my arms to protect them from flying glass and plaster, and expecting the house would fall around our heads. The deafening detonations and the terrific suction, which filled even my underclothing with glass splinters, produced a never-to-be-forgotten sensation, and the air was blue-gray with suffocating gas fumes, from which our throats smarted for days. Two hundred feet of our garden wall on the bank of the river was blown in, covering our lawn with brickbats. Probably one of these was responsible for the death of a university student, who lay just a few feet from our steps. My big first-aid basket was in service till the wee small hours. The planes had machine-gunned the river boats as they crossed the river from the city to the campus, and there were scores of dead, dying and wounded under the lee of our bank. Six bombs were dropped on the campus, three of which were duds, and to one of these latter we owe our lives, as it fell in the next yard—if it had exploded along with the one on our grounds our house would have gone, together with its inmates. Mrs. L. received a minor glass cut on her arm, and I had a deep glass splinter under the quick of one nail and some bruises from a flying door jamb, otherwise there were no injuries to the foreign faculty. The damage in the city was extensive, nine main business streets were demolished and over a thousand killed. Since

then the majority of the inhabitants have been ordered to move out to the country districts. Since I started this letter we learn that fifty-six planes threatened Chengtu last Saturday but were deflected by pursuit planes. Alas, our good fortune resulted in their bombing Kiating and Suifu, places mentioned earlier in this letter. The full of the moon will soon be upon us again—a most dreaded period. But enough of this phase of our life, and something regarding my daily routine.

Immediately after breakfast, my riksha boy, "Early Beginnings," trots me over to the city hospitals, a thirty-five minute run. To date I have spent three mornings a week in the men's hospital and three in the women's, giving anesthetics as needed, and giving all time not occupied in the operating room toward helping the General Superintendent of the United Hospitals with his correspondence. I cannot use shorthand but I take dictation to the machine readily. In June another task was assigned to me, that of organizing and managing a central supply room for the two hospitals. I secured a fine young Chinese assistant, and with his help inventoried the entire stock and divided it, putting the most valuable and easily breakable materials in a basement storeroom which we hope will be safer from bombing. It was a hard, hot task in smothering weather, and by the end of July I was rather "all in," especially as I had acquired a bothersome bit of bronchitis, so I came away to the hills fifty miles north, for a brief rest. Just when the new hospital will be completed and opened and my full time be spent there, is still in the lap of the gods. One just has to take duties as they are presented and make the best of it.

I have been enjoying lately Stanley Jones' "Victorious Living" in Chinese —a wonderfully written book in either tongue, full of inspiration for present-day problems. I have just finished reading "Men Against the Clouds" by Burdsall and Emmonds, as it depicts scenes in and beyond Szechwan, a part of China with which of course I am yet quite unfamiliar. Some of you at home may be interested in reading it. I am gratified to find that despite my three years in the States I have not forgotten too many of the fascinating Chinese characters. The young college student with whom I have been reading Dr. Jones' book complimented me on my command of the same, which of course somewhat tickled my vanity! I find the colloquial dialect used by the peasantry quite different from that of Shantung, but with the educated class my mandarin seems acceptable. I taught my classes in anesthesia to the medical students this year in Chinese, at their request, and judging by their grades at the end of the course, they had "gotten it."

Some of you wonder, in your letters, if mail is coming through all right under present conditions. Wonderfully well, I would say. It takes from six weeks to two months sometimes, if sent by ordinary post. Air mail from the States takes a month or so. Magazines are slower but so very welcome, for stories, articles, and fashions! We are hungry for all possible touch with the outer world. Our radios up here can seldom get a clear connection with the U. S. A. but we can usually get Manila, Hongkong, London and Berlin, and so depend on those contacts for our world news and music. I long for my victrola and records left in Nanchang—not to mention the box of new ones purchased with a special gift for the same, which I left at the Board Rooms in Boston till they could be sent to me safely. If your radios have consigned

your records and victrolas to some dusty corner of the attic, remember the missionaries! One must be cut off from good music to appreciate records.

We are glad, as medical workers, to stand by in China as long as we can, with such facilities as we can muster, for we are sorely needed. We know that you, our personal friends, will be praying for and loving us and sustaining us by your faith and trust. Stark need in every form stares us in the face. Thousands of homeless children, raging cholera epidemics, shortage of hospital equipment, medical and surgical supplies—all these and many another desperate call for aid. If there are any of you, or your friends, who can assist, we will be grateful. It is not possible just now to send us any materials by parcel post. The Board headquarters at New York might be able to include in some outgoing missionary's freight, surgical instruments, gloves, needles and the like. Money can always be used to best advantage, as exchange is good at this end, and it will enable us to use as far as possible that which can be purchased or manufactured locally. Send all such gifts to us in care of the Mission Board headquarters, for the present. In ordinary times bank drafts are negotiable in the interior, but not just now. Blankets are especially needed in all three of our hospitals, and given funds, I hope to negotiate with some one of the government cooperative concerns for weaving material to make these.

Some of you professional folk will be both amused and interested to know that my latest venture this summer was to have a good carpenter make us wooden bedpans, the joints carefully dovetailed, and the finished product given several coats of heavy waterproof varnish. They will at least be better than none! Galvanized iron is not purchasable here now, and foreign enamel ones are not obtainable short of Hongkong, neither do we have the funds to purchase such. In my capacity as head of the central supply room I am naturally vitally concerned with the upkeep of such supplies. It may interest you that approximately fifty cents gold will cover the cost of such a bedpan, while an imported one would be as many dollars in local currency.

Coffee by the way is forty dollars a pound (lucky me, since I never drink it); baking powder twenty dollars a pound; cheap blue cloth sixty cents a foot—small wonder the average coolie goes in tatters. I am thankful for every piece of soap I tucked into my baggage, with imitation native Palmolive selling at seventy cents a cake, and the last Ivory soap obtainable at three dollars a bar, no more of this can be had while the war is on). These prices are bad enough for us with a favorable rate of exchange on our gold salaries, but they mean great hardship for the common people.

This letter is quite too long, but I wanted to get some of these details out to you before the coast exits are bottled up more tightly. It takes to you each and all my warmest greetings, and the hope that you will not forget your friend in far-off Szechwan.

Faithfully and sincerely,

MYRA L. SAWYER

West China Union University Hospital,
Chengtu, Szechwan, West China, August, 1939.

NOTES ON PHYSIOLOGY

The anesthetist, in order to make the best of every opportunity in the management of an anesthesia, must have a workable understanding of human physiology, especially with reference to the respiratory, cardiovascular and nervous systems. It is not enough to understand the functions of these systems, but it is also necessary to have a clear conception of how the functions of these systems are altered by disease, since many of the patients requiring anesthetics are by no means normal, healthy individuals. There is no textbook of physiology written particularly for the student anesthetist. Hence, this outline has been prepared, not as a treatise on physiology but as an aid in covering the material of particular importance to the anesthetist in the various textbooks of human physiology.

Physiology is the study of the functions of cells, organs, and organisms, not only from the point of view of finding out what is happening but to attempt as far as is possible to explain physiological processes on the basis of physical and chemical phenomena. It is not enough to know that respiration is concerned with bringing the oxygen of the atmosphere into contact with the blood and thence carrying it to the tissue cells; but one must inquire into the physical and chemical forces that propel the oxygen molecules from the atmosphere to the body cells. It must also be appreciated at the outset in the study of human physiology that the facts set forth in the textbooks are the result of *critical laboratory experimentation* and that the subject deals with *dynamic processes* and must be thought of in that light. One must construct mental motion pictures of these processes and not attempt to remember word definitions. One should pay particular attention in the textbooks to the graphic representations of the inter-relationship of variable factors. The student should learn and be able to describe physiological inter-relationships graphically and diagrammatically, using word descriptions to clarify the graphic representations.

In order to get a proper point of view for the understanding of organs or organisms, we must begin with the biological unit of life—the cell. In mammalian physiology we can consider all cells to be in a liquid medium. Every cell is encased in a complete and intact cell membrane; hence in any transfer of substances between cell and environment these substances must pass through the cell membrane. Here we must digress to discuss the physical chemistry of solutions of *non-electrolytes, electrolytes,* and of *semi-permeable* membranes. Cell membranes are semi-permeable in that some *ions* and *molecules* pass through the membrane freely while others pass through with difficulty or not at all. Furthermore, these membranes are physiological structures; they are not constant but vary in permeability with changes in and around the cells.

It is quite obvious then that the physico-chemical mechanisms for the transfer of substances across semi-permeable membranes are of fundamental importance in the study of body economy.

These mechanisms are:

1. Filtration
2. Diffusion
3. Osmosis

The concept of filtration is simplest. A solution under pressure on one side of a semi-permeable membrane results in the forcing through the membrane of molecules to which the membrane is permeable, leaving behind the molecules to which the membrane is not permeable. The best example of this is to be found in the kidney where each glomerulus is a filtration unit. The pressure of the blood in the capillaries of the glomerulus is sufficient to force water and dissolved substances out of the blood stream into the subcapsular space of Bowman's capsule which capsule is connected with the urinary tubules. The cells and large protein molecules of the blood do not normally pass through these membranes.

Diffusion is the process by which molecules and ions pass from areas of high concentration to areas of lower concentration by virtue of the molecular motion. We know, for example, that if a rubber balloon is filled with pure carbon dioxide, the rubber wall is being bombarded continuously by carbon dioxide molecules from both the inside and the outside, but since there is a greater number of the carbon dioxide molecules per unit of volume on the inside than in the atmosphere on the outside, the bombardment is much heavier from within out. Since the wall is permeable to carbon dioxide molecules, there is a gradual leakage of carbon dioxide from the bag. Carbon dioxide molecules are much more diffusible than oxygen. Helium is much more diffusible than nitrogen. In the process of diffusion, molecules always move from volumes of high concentration to volumes of lower concentration.

The concept of osmosis is considerably more difficult. Osmosis occurs only when there is a *semi-permeable* membrane interposed between two solutions containing dissolved molecules and ions to which the membrane is not permeable. In such a case the solvent—which we can consider to be water in physiological studies—moves across the membrane in such a way as to dilute the dissolved substances. Thus, when a cell is placed in a solution having fewer dissolved molecules and ions than are contained in the cell, water moves into the cell causing the cell to increase in size. On the other hand, if the concentration outside the cell is greater, water moves out of the cell. The osmotic pressure depends not upon the size of the molecules but upon the number per unit of volume of solution. Electrolytes, such as sodium chloride, which dissociate into ions exert a greater osmotic pressure per molecule than non-electrolytes, such as glucose, since for each salt molecule we have two or more ions, or particles, when in solution as compared to only one particle per molecule for non-electrolytes. Using the kidney unit again as an example, Bowman's capsule is impermeable to protein molecules and hence the osmotic pressure of the proteins tends to pull water from the subcapsular space back into the blood stream. Thus, when the filtration pressure is lowered to the equivalent of the osmotic pressure of the plasma proteins, the formation of filtrate ceases. This is why the formation of urine ceases long before the pressure of the blood in the arteries, arterioles and capillaries reaches zero; *it ceases when the opposing forces are equal, namely, when the filtration pressure equals the osmotic pressure of the plasma proteins.*

Perhaps a word should be said about electrical manifestations across semi-permeable membranes. When ionized solutions of different concentrations are separated by a semi-permeable membrane, a suitable electrical voltage record-

ing device would show the existence of an electrical potential or voltage across the membrane. This potential varies in precise mathematical relationship as the difference in concentration of the ions on the two sides of the membrane varies. This, of course, is an adequate explanation of the electrical phenomenon associated with metabolic activity, such as action currents of muscles, nerves, the electrocardiogram, electroencephalogram, et cetera. The electrical potentials are not the *cause* of vital physiological phenomena but the *result* or *byproduct* of such activity, just as *heat* and *work* are the result of *chemical reactions* taking place within the cells. This will be discussed in more detail in regard to metabolism.

Living cells are generally quite sensitive to changes in environment. A change in cell environment is referred to as a *stimulus*—an effective stimulus if there is a response on the part of the cell to the change in environment.

Various environmental factors or stimuli are:

1. Mechanical
2. Thermal
3. Electrical
4. Chemical
    a. Acidity
    b. Specific—which may include specific ions as Na, K, Ca, et cetera, also toxins and hormones.

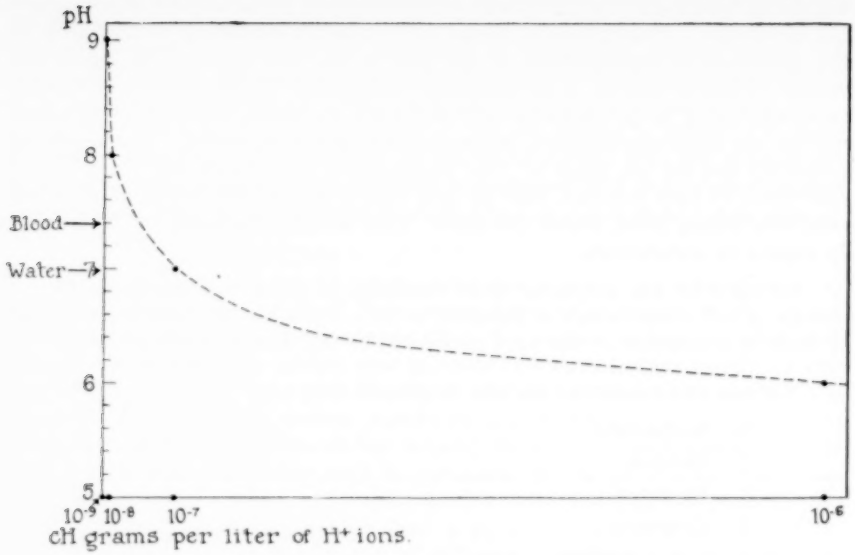
Most of these are quite obvious but the importance of the acidity of the cell environment may not readily be appreciated. The regulation of acidity is one of the most precisely regulated mechanisms of the body. Cells are *very sensitive to changes in acidity.*

One must differentiate between (a) the amount of acid and (b) the strength of acid. The amount of acid depends upon the amount of base required to neutralize a given amount of acid. The strength of the acid depends upon the degree of *ionization*, the quantity of H+ ions per unit volume.

Water contains 10^{-7} grams (1/10,000,000 or 0.0000001) of H+ ions per liter and is assumed to be *neutral* (also to contain a chemically equivalent amount of –OH ions). The concentration of H+ ions, represented by the symbol C_H, can be most simply expressed as grams/liter of H+ ions. It is known from physicochemical data that when a special electrode is inserted into a solution an electrical potential develops which is quantitatively related to the C_H. The existence of such a potential was discussed under osmosis.

$$E \text{ (volts)} = 0.059 \log_{10} \frac{1}{C_H} + 0.282$$

For convenience in measurements $\log_{10} \frac{1}{C_H}$ has been designated as pH, the accepted biological quantitative measure of degree of acidity.



Relationship cH to pH

$$10^{-7} = \frac{1}{10{,}000{,}000} = 0.0000001$$

pH of 7 has 10x the H+ of a pH of 8
pH of 6 " " " " " " " " 7
pH of 5 " " " " " " " " 6, et cetera

The degree of acidity of the cell environment is controlled by *buffers. A buffer is a solution of a weak acid and of one of its salts.* A few drops of a strong acid in water will cause a tremendous increase in C_H and pH. The same few drops of acid in a buffer solution will produce a very small change in C_H and pH. For example, one of the blood buffers is the carbonic acid-bicarbonate system. In this system

C_H is proportional to the ratio $\frac{H_2CO_3}{BHCO_3}$

where B stands for basic ion — the principal basic ions in the blood being Na, K and Ca.

If HCl is added to this system, it reacts with the bicarbonate as follows:

$$HCl + NaHCO_3 \longrightarrow NaCl + H_2CO_3$$

Thus the chemical in the denominator of the ratio $\frac{H_2CO_3}{NaHCO_3}$ is converted into that of the numerator. With increase of H_2CO_3 in the blood the equilibrium of $H_2CO_3 \rightleftharpoons H_2O + CO_2$ is disturbed and CO_2 is given off in the lung. This reduces the numerator of the ratio so that the addition of a strong acid has had little effect on the ratio and consequently little effect on the C_H and hence pH of the blood.

It is necessary to have some sort of concept of these physico-chemical phenomena as a basis for discussing the transport of oxygen and carbon dioxide, control of respiration, metabolism, et cetera. F. R. M.

COMMUNICATIONS FROM SPECIAL COMMITTEES

Questionnaire Committee

A special committee is preparing a questionnaire to be sent to every hospital in the United States for the purpose of obtaining information in regard to anesthesia service, and particularly the number of nurse anesthetists. We know that each state organization desires to increase its membership and we ask your cooperation in securing the information requested.

Let me give you some interesting facts and figures:

Did you know:

That there are approximately 6,183 hospitals in the United States;

That over nineteen hundred nurse anesthetists are now members of the American Association of Nurse Anesthetists;

That twenty-five State Associations of Nurse Anesthetists are already organized;

That thirty-nine Schools of Anesthesia for registered nurses are listed;

That a Trust Fund has been established by the American Association of Nurse Anesthetists to "provide for such members of this Association who may become indigent through age or permanent disability"?

In handling this valuable survey the approximate cost for postage alone, not including printing, is as follows:

Alabama	$ 4.98	New Jersey	10.02
California	21.78	New York	34.56
Colorado	6.06	Ohio	15.12
Florida	5.46	Oklahoma	7.38
Georgia	6.48	Oregon	4.38
Illinois	18.24	Pennsylvania	21.00
Indiana	8.16	Tennessee	5.76
Michigan	13.98	Texas	18.06
Minnesota	13.20	Virginia	6.42
Mississippi	4.38	Washington	7.02
Missouri	8.64	Wisconsin	13.08
Nebraska	5.88	Hawaii	2.76

When your State Association meets, will you allow a few moments of your program for consideration of the above facts? It is for your benefit that such a survey has been proposed and we urge your wholehearted support.

HILDA R. SALOMON, *Chairman*

Seal Committee

The change in the name of the Association effected at the annual meeting held in Toronto, Canada, in September, 1939, and the adoption of a revised constitution and by-laws, with the reincorporation of the organization in the state of Illinois, led to discussion of a seal for the corporate body. It was decided to refer this matter to a committee which should gather in suggestions from the membership for the design to be used. When the association is in position to make such use of it, the design chosen will also be used on the pin.

Selection will be made on the basis of beauty, simplicity and symbolism.

This affords wide scope for the artistic expression of originality and idealism hidden among the many other talents possessed by our membership.

Will everyone interested in developing a seal and pin that we will all enjoy, please send their suggestions to the Chairman of the Seal Committee, Louise Schwarting, Lutheran Hospital, Fort Dodge, Iowa. Final selection of the winning design will probably be by vote at the annual convention in Boston in September, 1940.

Please do not let inability to draw well deter you, as the execution of the design will be done by an artist. We only wish to draw creative ideas from our members; having those, their embodiment will be easy. So send us your inspiration—ever so roughly sketched—and be happily surprised in the working out of its possibilities, and earn the gratitude of all of us—but especially of the Seal Committee.

LOUISE SCHWARTING, *Chairman*

GRACE HOSPITAL ALUMNAE ASSOCIATION ORGANIZED

At a breakfast meeting held at the King Edward Hotel in Toronto during the convention of the American Association of Nurse Anesthetists, Mrs. Florence Howard was asked to act as Chairman of a meeting to be called at a later date, for the purpose of organizing Grace Hospital School of Anesthesia Alumnae Association.

The organization meeting was therefore called for Friday, November 3, 1939, at Woman's Hospital, Detroit, Mich. Twenty-two graduates of Grace Hospital School of Anesthesia attended the meeting. Mrs. Howard explained the purpose for which the meeting was called and emphasized the value to the school and to the graduates of an active Alumnae Association.

Miss Doris Bell, Miss Alice V. Zolman and Miss Alice S. McWhorter were appointed to act as a Nominating Committee, and the following officers were elected:

President	Helen Tucker Woman's Hospital, Detroit, Mich.
First Vice-President	Ernestine F. Williams Florence Crittenton Hospital, Detroit
Second Vice-President	Alice V. Zolman Pontiac General Hospital, Pontiac, Mich.
Secretary	Carmen A. Eckhart Redford Receiving Hospital, Detroit
Treasurer	Ada Snider Grace Hospital, Detroit
Board of Directors	Florence C. Howard Alice S. McWhorter Esther Louise Ilgenfritz Mable Courtney

Committee Chairmen appointed:

Finance	Gladys L. Lenze
By-Laws	Ethel M. Moir
Program	Florence C. Howard
Membership	Aleise Killingworth
Publicity	Anna Mae Palmer

It was decided that meetings would be held the second Thursday of each month. The membership will be divided into three classes—Honorary, Active and Associate; dues for active members $1.50 per year, associate $1.00. The Membership Committee was instructed to invite all Grace Hospital School of Anesthesia graduates to make application for membership in the newly formed Association.

At a special meeting held on December 13, 1939, Dr. Myra Babcock, Director School of Anesthesia, Grace Hospital, was elected an Honorary member.

CARMEN A. ECKHART, *Secretary*

ACTIVITIES OF STATE ORGANIZATIONS

CALIFORNIA

At the invitation of Miss Olga Schreiber, of Woodland Clinic, twenty-nine members of the California Association drove one hundred and twenty-nine miles from San Francisco to Woodland, California, for their January meeting.

Following a delightful cocktail party at the home of Dr. and Mrs. Homer Woolsey, a dinner was held at the Hotel Woodland. Talks were given by Dr. Fairchild and Dr. Roller of Woodland Clinic, both of whom emphasized their high regard for the work of the nurse anesthetists.

ILLINOIS

Sixty-seven members and guests of the Illinois Association of Nurse Anesthetists (organized within the year) met at Ravenswood Hospital, Chicago, the evening of November 15, 1939.

A complete report of the annual meeting of the American Association was given by Miss Hattie Lewis, of St. John's Hospital, Springfield, Ill., who represented the Illinois group at the convention in Toronto, and the members were reminded of the changes necessary in the State Association By-Laws to conform with those made by the American Association. The Treasury was satisfactorily stimulated to the extent of an additional $300, due to the efforts of many of the members in disposing of tickets for a turkey raffle.

An instructive address was given by Dr. Clark A. Buswell of Ravenswood Hospital, on "The Discovery of Ether Anesthesia," illustrated with motion pictures.

This encouraging meeting was concluded with a social hour and refreshments.

The Association regrets to announce the resignation of its first President, Miss Mabel Nichol, who is leaving Chicago. Her efforts as an officer have been sincerely appreciated.

FLORIDA

The annual meeting of the Florida Association was held in Orlando on November 15, 1939. An interesting report of the National convention in Toronto was given by Miss Marjorie Watts, who pointed out the increase in the membership of the Association and the change in name. A lively discussion in regard to cyclopropane anesthesia followed.

It was voted to meet twice yearly in the future, i.e., an annual meeting in Florida in November, and a joint meeting in April with the Southeastern Assembly of Nurse Anesthetists.

The following officers were elected unanimously for the coming year:

Marjorie Watts, President

President
Marjorie L. Watts
c/o Dr. T. C. Maguire, Plant City

Vice-President
Emma Easterling
Jackson Memorial Hospital, Miami

Secretary-Treasurer
Ruth Ballintine
Johnston's Sanitarium, Tallahassee

Trustees:
Lenella Bradbury (new)
Margaret Creelman (new)
Nellie Davis
Mary C. Brown

Committees:

Revisions
Nellie G. Davis, Chairman
Margaret Creelman
Jennie A. Card

Membership
Ida T. Ellis, Chairman
Lenella Bradbury
Mary Phillipoff

Legislative	Evon Compton, Chairman
	Frances Muren
	Ema Beach
Education	Iva S. Grant, Chairman
	Willie Lee Davis
	Inez G. Davis
Program	Emma Easterling, Chairman
	Ida T. Ellis
	Edith Halton
Nominating	Iva S. Grant, Chairman
	Margaret Creelman
	Mary C. Brown
Finance	Ruth Ballintine, Chairman
	Mary Phillipoff
	Florence Kenney

MICHIGAN

The second anniversary meeting of the Michigan Association was held at Grace Hospital, Detroit, on November 11, 1939, with thirty-eight members present. The welcoming address was given by Dr. Collins, Superintendent of Grace Hospital.

Miss Anna Willenborg, Executive Secretary of the American Association of Nurse Anesthetists, gave a talk on "Activities at Headquarters" and answered many pertinent questions. Miss Kathleen Sturgeon, of the University of Michigan Hospital, Ann Arbor, read a paper on "Pentothal Sodium" (published on page 23 of this issue), showing slides of equipment for pentothal sodium tray. Miss Mable Courtney of Grace Hospital, and Miss Esther Meil of Henry Ford Hospital, Detroit, gave a joint report of the annual convention held in Toronto.

The Michigan Association has accepted the invitation of the Tri-State Hospital Association to meet with them on May 1-3, 1940, in Chicago, Illinois.

MINNESOTA

The Official Bulletin has been used very successfully in maintaining the interest of the members of the Minnesota Group. The first fall meeting, with seventeen members present, was held at St. Mary's Hospital, Minneapolis, on October 31st, and Sister Leonissa and Miss Elizabeth Gartner of St. Mary's Hospital were hostesses. Miss Borghild Grebstad gave a report of the National convention in Toronto, which was attended by six members from the Minnesota Association.

The next meeting was held on November 28th, in the Nurses' Club Rooms, Lowry Building, St. Paul, with the staff at St. John's Hospital as hostesses. Miss Mable Root, of Minneapolis General Hospital, read a paper on "Shock." An interesting discussion followed regarding questions brought up at the annual meeting in Toronto.

The Minnesota Association has under consideration a tentative plan for a second course of lectures. Suggestions or inquiries should be addressed to Alice Anderson, Minneapolis General Hospital, Minneapolis, Minn.

Treasurer's Report

Cash in Bank October 1, 1939		$ 301.63
Receipts		
Dues	$ 12.00	12.00
		$ 313.63
Disbursements		
National Dues	$ 6.00	
Typing services	3.50	
Expenses of delegates to National convention in Toronto	50.00	
Flowers at convention	2.00	
Postage	1.00	62.50
Cash in Bank November 1st, 1939		$ 251.13

Officers

Alice Anderson, President, Minneapolis General Hospital
Marie Petrowski, Vice-President, Ancker Hospital, Saint Paul

Dorothy Koch, Secretary, Minneapolis General Hospital
Grethe Westly, Treasurer, Deaconess Hospital, Minneapolis

Trustees

Marie Gronvold, Saint Joseph's Hospital, Saint Paul
Mable Root, Midway Hospital, Saint Paul
Maple Baer, Saint John's Hospital, Saint Paul
Hazel J. Peterson, Fairview Hospital, Minneapolis
Borghild Grebstad, Northwestern Hospital, Minneapolis

Committees

Program and Publications:

Pearl Lemke, Chairman, University Hospital, Minneapolis
Hazel Peterson, Fairview Hospital, Minneapolis (Editor Bulletin)
Charlotte Grams, Gillette Hospital, Saint Paul
Palma Anderson, Deaconess Hospital, Minneapolis

Educational:

Mildred Mathews, Chairman, Abbott Hospital, Minneapolis
Mable Root, Midway Hospital, Saint Paul
Maple Baer, Saint John's Hospital, Saint Paul
Marie Petrowski, Ancker Hospital, Saint Paul
Christine Nichols, Swedish Hospital, Minneapolis

Membership:

Katherine Jurgenson, Chairman, Swedish Hospital, Minneapolis
Clara Vandervelde, Saint Barnabas Hospital, Minneapolis
Ruby LeJeune, Mounds Park Hospital, Saint Paul
Ruth Walthers, General Hospital, Minneapolis
Julia Filla, Miller Hospital, Saint Paul

Legislation:

Leah Thoraldson Wilson, Chairman, 2603 Elliot Avenue, Minneapolis
Ellen Lonergan, Glen Lake Sanitarium, Oak Terrace
Myrtle Rosengren, Shriners Hospital, Saint Paul

Social:

Julo Slattendale, Chairman, University Hospital, Minneapolis
Borghild Grebstad, Northwestern Hospital, Minneapolis
Esther Rodenberg, Gillette Hospital, Saint Paul

The sixth annual meeting of the Minnesota Association will be held in Minneapolis May 23-25, 1940, in conjunction with the Minnesota Hospital Association. For further information write Miss Dorothy L. Koch, Secretary, Minneapolis General Hospital, Minneapolis, Minn.

NEBRASKA

The Nebraska Association of Nurse Anesthetists held a meeting in Omaha on November 12, 1939, at which Miss Leona Nelson, Secretary-Treasurer, gave a report of the meeting of the American Association.

The Nebraska group feel that their organization has been a great help to them individually, affording opportunity for discussion of common problems. The local meetings have also helped to stimulate interest in the national conventions, and the social hours have created a better understanding in the group.

Officers:

President	Elizabeth I. Dugan St. Joseph Hospital, Omaha
Vice-President	Ellen Brogan St. Elizabeth Hospital, Lincoln
Secretary-Treasurer	Leona K. Nelson St. Joseph Hospital, Omaha

NEW YORK

Tentative Program

Seventh Annual Meeting

New York Association of Nurse Anesthetists

Hotel New Yorker, New York City

May 22-24, 1940

Wednesday, May 22

9:00 A.M. Registration — Parlors F and G

GENERAL SESSION

Mrs. Charlotte McCoy presiding

10:00 A.M. "Atelectasis"
Henry W. Louria, B.A., M.D.
Associate Surgeon, Kings County Hospital
Junior Attending Surgeon and Chief of Thyroid Clinic, Jewish Hospital

10:30 A.M. "Spinal Anesthesia"
Lynn H. Halbert, B.S., M.D.
Associate Surgeon and Attending Roentgenologist, Staten Island Hospital; Attending Surgeon, Richmond County Contagion and Seaside Hospitals

11:00 A.M. "Rectal Anesthesia"
Helen K. Craven
City Hospital, Welfare Island, New York City

11:30 A.M. "Anesthesia for Malignant Cases of Head and Neck"
Helena F. McManus
Memorial Hospital, New York City

1:00 P.M. Group Luncheon—North Ball Room
Chairman—Mrs. Charlotte McCoy
"The Theater of Today"
Maude Scheerer, Guest Speaker

2:30 P.M. Fashion Parade (courtesy Oppenheim and Collins) under the direction of Miss Ware

3:30 P.M. Drawing—Diamond Wrist Watch

4:00 P.M. Business Meeting—Hazel Blanchard, President, presiding
Election of Officers

Thursday, May 23rd

10:00 A.M. Field Trip to plant, E. R. Squibb & Sons
Luncheon enroute—Roger Smith Hotel, New Brunswick, N. J.

7:00 P.M Theater Party—Radio City

10:45 P.M. After-theater Party—"The Gay Nineties Club"
Sara Mullin in charge

(Please register for Thursday's activities at the registration desk)

Friday, May 24th

9:00 A.M. Clinic—Kings County Hospital, Brooklyn
"Intratracheal Anesthesia and Cyclopropane"
Paul Ansboro, M.D.

11:00 A.M. Inspection of Operating Rooms

2:00 P.M. Round Table—Parlors F and G
Frances Hess, Long Island College Hospital, presiding

3:00 P.M. Unfinished Business—Hazel Blanchard presiding
Introduction of New Officers

4:00 P.M. Meeting—Board of Trustees

ANESTHETISTS FROM OTHER STATES WILL BE WELCOME AT ALL SESSIONS

For further information write Miss Hazel Blanchard, President, 1910 Seventh Avenue, Troy, N. Y.

OKLAHOMA

The fourth annual meeting of the Oklahoma Association of Nurse Anesthetists, which was well attended, was held at the Skirvin Hotel, Oklahoma City, on November 16, 1939, in conjunction with the Oklahoma Hospital Association. Included on the program was an interesting demonstration of oxygen therapy.

It was decided to send two members to the regional meeting of anesthetists to be held in conjunction with the Mid-West Hospital Association convention at Hotel Continental, Kansas City, Missouri, April 11-12, 1940.

The following officers were elected:

President
Martha Puett
Masonic Hospital, Cushing

First Vice-President
Dixie Lee Diefenderfer
Wesley Hospital, Oklahoma City

Second Vice-President
Eula McNiel Park
920 South 6th St., McAlester

Historian
Eleanor V. Smith
Wesley Hospital, Oklahoma City

Trustees (3 year)
Beatrice Pitt
Estelle Graham

Martha Puett, President

OHIO

The seventh annual meeting of the Ohio Association of Nurse Anesthetists will be held April 2-4, 1940, at the Deshler Hotel, Columbus, Ohio, in conjunction with the Ohio Hospital Association. For further information write Miss Mildred Sauers, Secretary-Treasurer, City Hospital, Cleveland, Ohio.

OREGON

The Oregon Association has held three meetings since their winter series began. At the November meeting Captain C. A. Raymes of the Portland Fire Department gave an interesting talk on "Explosive Hazards" including a review of the Fire Rules for the Portland area.

The third annual meeting was held in Portland on December 18th, and a definite increase in membership and general interest was evidenced by the reports given by the President, Secretary and Treasurer.

Officers elected

President

Anne Feser
308 Medical Dental Bldg., Portland

First Vice-President

Ida C. Paulson
Oregon City Hospital, Oregon City

Second Vice-President

Marie Floren
Emanuel Hospital, Portland

Secretary

(to be appointed)

Treasurer

Margaret H. Love
3130 N. E. 19th St., Portland

Trustee

Hazel Butler
2166 N. W. Irving St., Portland

Anne Feser, President

TEXAS

The fifth annual meeting of the Texas Association of Nurse Anesthetists will be held February 22-24, 1940, at the Gunter Hotel, San Antonio, in conjunction with the Texas Hospital Association. An interesting program is being planned and a large attendance anticipated.

For further information write Miss Marcella A. Cable, Secretary-Treasurer, Hermann Hospital, Houston, Texas.

ANESTHETISTS' ASSOCIATION OF FORT WORTH, TEXAS

The Fort Worth Association had an active year, monthly meetings being held with the exception of June, July and August. Several of the doctors in Fort Worth have taken an active part in the programs.

During the series Dr. F. L. Snyder discussed the effects of anoxemia from any cause. Dr. Sidney Stout discussed at length the value of oxygen therapy and emphasized the importance of recognizing the proper time for its use. Dr. H. K. Beall reported several cases of convulsions during anesthesia and advanced the theory that the origin may be "heat stroke." He stated that since providing for circulation of air beneath the sterile draping, the body temperature of his patients has not risen unduly and no convulsions have occurred.

At the December meeting ten anesthetists from Dallas were guests of the Fort Worth group.

The next meeting will be held at the Federal Narcotic Farm, with a tour of the institution followed by a talk by Dr. W. F. Ossenfort, Superintendent.

Officers elected, September, 1939:

President	Grace Richardson
Vice-President	Mary E. Stratton
Secretary-Treasurer	Laura Hoffman

TENNESSEE

The Tennessee Association of Nurse Anesthetists will hold its annual meeting in conjunction with the annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly, February 14th and 15th, 1940, at the Hotel Peabody, Memphis, Tenn. The business session will convene at 4:00 p.m. on February 14th.

For further information write Miss Jewelle C. Fink, Physicians and Surgeons Bldg., Memphis, Tenn.

VIRGINIA

Fifteen members of the Virginia Association gathered for the fifth annual dinner and meeting, which was held in the Club Room of the Montecello Hotel, Charlottesville, Va., on December 2, 1939, the President of the Association, Mrs. Minnie Freese Payne, presiding. Dr. E. C. Drash gave a talk on "The Advancements in Anesthetics," and papers were read by several members of the organization.

The next annual meeting will be held for a half day, beginning at noon, on Saturday, April 27, 1940, in Richmond, Va.

Officers for 1939-1040:

President
Eloise S. Ward
Norfolk Gen'l Hospital, Norfolk

Vice-President
Georgia C. Scott
Lewis-Gale Hospital, Roanoke

Secretary-Treasurer
Clara V. Anderson
Norfolk Gen'l Hospital, Norfolk

Eloise S. Ward, President

Trustees (3 year)	Cora Massie
	Marguerite B. Shiley
Program Committee	Cora Massie
	Lorene L. Robinson
	Cordelia Bakes
Nominating Committee	Carrie V. Mays
	Nancy F. Forgie
	Agnes Farrell
Membership Committee	Gladys Leftwich
	Marguerite B. Shiley
	Martha E. Nitsche
Revisions Committee	Minnie Freese Payne
	Marie Farris Doss
	Vera G. Copeland

WASHINGTON

Both the Eastern and Western Divisions of the Washington Association have held well attended and well planned monthly meetings since September, and have made plans for classes during 1940, using textbooks approved by the American Association of Nurse Anesthetists.

The meetings of the Eastern Division have been held at the Sacred Heart Hospital, Spokane, including a dinner and entertainment in December.

The members of the Western Division have met in Tacoma, Everett and Seattle, with a guest speaker, usually a doctor, on each program.

WISCONSIN

The annual meeting of the Wisconsin Association of Nurse Anesthetists was held at the Hotel Wausau, Wausau, Wis., on November 4th, 1939. Clinics were held at the Wausau Memorial Hospital and at St. Mary's Hospital, and the following papers were read:

(a) "Physiology of the Heart During Anesthesia"
(b) "Helium and Oxygen Therapy"
Erwin P. Ludwig, M.D., Wausau, Wis.

"Statistical Study of 1500 Administrations of Cyclopropane"
Esther Edwards, Wausau Memorial Hospital, Wausau, Wis.

"Chest Surgery and Its Relation to Anesthesia"
Joseph Gale, M.D., University of Wisconsin, Madison, Wis.

"Anesthesia Notes and the Nurse Anesthetist"
Mae B. Cameron, Director of Anesthesia, Ravenswood Hospital, Chicago, Ill.

"The Importance of Anesthesia to the Surgeon"
Harold Fehland, M.D., Wausau, Wis.

The group were the guests of Miss Esther Edwards at a "Hospitality Breakfast." A "Courtesy Luncheon" was held at noon, and a banquet in the evening in the Ball Room of the Wausau Hotel. A musical program preceded the dinner, followed by the introduction of the officers and distinguished guests, and an address by the guest speaker, Dr. Merritt LaCount Jones.

The Wisconsin Association has put out a most attractive mimeographed program for the year's activities, including a list of the members.

Officers, 1939-1940:

President	Mary Ann Yanulis Municipal Hospital, Beloit
First Vice-President	Ada M. Flasch St. Mary's Hospital, Milwaukee
Second-Vice-President	Mabel E. Johnson Sheboygan Memorial Hospital, Sheboygan
Secretary	Leone A. Thielen St. Mary's Hospital, Racine
Treasurer	Melva L. Werking St. Joseph's Hospital, Milwaukee
Trustees (3 year)	Esther Edwards Viola Taylor

MID-SOUTH POST GRADUATE NURSE ANESTHETISTS' ASSEMBLY

The sixth annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly will be held February 14th and 15th, 1940, at the Hotel Peabody, Memphis, Tennessee, in conjunction with the Mid-South Post Graduate Medical Assembly.

Officers:

Martha Brown, President
Louise Halford
Gilberta H. Snow } Vice-Presidents
Elizabeth N. Wates
Alice Maurine Sims, Secretary

Program Committee

Hattie Vickers
Theresa W. Trail
Jewelle C. Fink

For further information write Miss Alice Maurine Sims, Secretary, 704 Goodwyn Institute, Memphis, Tenn.

SOUTHEASTERN NURSE ANESTHETISTS' ASSEMBLY

The second annual meeting of the Southeastern Nurse Anesthetists' Assembly will be held at Edgewater Park, Miss., (between Biloxi and Gulfport), March 28-30, 1940, in conjunction with the Southeastern Hospital Conference.

The convention hotel is situated on the Gulf of Mexico, surrounded by points of irresistible interest to those who have never visited this section of the deep South: Mobile, with her Azalea Trail and famous Bellingrath Gardens; quaint Biloxi, first capital of the French Province of Louisiana and one of the oldest cities in the United States; Gulfport, Mississippi's gateway to the seven seas; the fertile Mississippi delta where the finest cotton in all the world is raised; and only two hours away by railroad to New Orleans, the incomparable.

Edgewater Park is a semi-tropical, winter pleasure community with more than three hundred acres devoted to outdoor recreation, including 18-hole golf course; outdoor swimming pool; salt and fresh water fishing; motor boating and sailing; horseback riding (many miles of wooded bridle paths); tennis courts and extensive lawns and gardens. The famous "Old Spanish Trail"

Edgewater Gulf Hotel, where Southeastern Nurse Anesthetists' meeting will be held

(U. S. Route 90) connecting Florida and California, passes through the hotel grounds, and hard surfaced all-year motor highways lead to the Edgewater Gulf Hotel, Convention Headquarters, from all parts of the country.

An interesting program is being prepared, including an educational booth, and a large attendance is anticipated. Gertrude L. Fife, of the University Hospitals of Cleveland, Ohio, will be a guest speaker on the program—subject, "Anesthesia in Surgery of the Heart." She will also read a paper before the Hospital group on "The Organization of an Anesthesia Department in a Small Hospital."

President — Rosalie C. McDonald
Emory University Hospital, Emory University, Ga.

Secretary-Treasurer	Ida Tedford Ellis Orange County Hospital, Orlando, Fla.
Program Committee	Anne M. Beddow, Chairman Norwood Hospital, Birmingham, Ala. Elizabeth N. Wates 3950 Council Circle, Jackson, Miss. Iva S. Grant 108 E. Central Ave., Orlando, Fla.
Local Arrangements	Sue M. Collins 1850 Father Ryan Ave., Biloxi, Miss.

For further information write Mrs. Rosalie McDonald or Miss Annie M. Beddow.

PITTSBURGH ANESTHETISTS

The University Hospitals anesthetists have scheduled the following spring meetings:

February 6th	Elizabeth Steele Magee Hospital
March 5th	Children's Hospital
April 2nd	Eye and Ear Hospital

and a banquet is being planned for May.

For further information please get in touch with Miss Frances Wolak, St. Francis Hospital School of Nursing, Pittsburgh, Pa.

COMING MEETINGS

Florida	Joint meeting with Southeastern Nurse Anesthetists' Assembly, Edgewater Park, Miss., March 28-30, 1940. Annual meeting in November, 1940.
Michigan	Joint meeting with Tri-State Hospital Association, Chicago, Ill., May 1-3, 1940.
Minnesota	Sixth annual meeting, in conjunction with the Minnesota Hospital Association, Minneapolis, Minn., May 23-25, 1940.
New York	Seventh annual meeting, Hotel New Yorker, New York City, May 22-24, 1940.
Ohio	Seventh annual meeting, Deshler Hotel, Columbus, Ohio, April 2-4, 1940, in conjunction with the Ohio Hospital Association.
Pennsylvania	Ninth annual meeting, May 8-10, 1940, Pittsburgh, Pa., in conjunction with Hospital Association of Pennsylvania.
Tennessee	Annual meeting, February 14-15, 1940, Hotel Peabody, Memphis, Tenn., in conjunction with Mid-South Post Graduate Nurse Anesthetists' Assembly.
Texas	Fifth annual meeting, Gunter Hotel, San Antonio, Texas, February 22-24, 1940, in conjunction with Texas Hospital Association.
Virginia	Annual meeting, beginning at noon Saturday, April 27, 1940, in Richmond, Va.

Wisconsin	Annual meeting, November 9, 1940.
Mid-South Post Graduate Nurse Anesthetists' Assembly	Sixth annual convention, Hotel Peabody, Memphis, Tenn., February 14-15, 1940, in conjunction with the Mid-South Post Graduate Medical Assembly.
Regional meeting	Mid-West Hospital Association convention, Hotel Continental, Kansas City, Mo., April 11-12, 1940.
Southeastern Nurse Anesthetists' Assembly	Second annual meeting, Edgewater Park, Miss., March 28-30, 1940, in conjunction with Southeastern Hospital Conference.

NOTICE

PAYMENT OF DUES

Due to confusion in the minds of some of our members as to where annual dues should be sent, proper procedures are outlined below:

In *organized states* please send check or money order to Secretary or Treasurer of the State Association.

In *unorganized states* send check or money order direct to Gertrude L. Fife, Treasurer, 2065 Adelbert Road, Cleveland, Ohio.

ASSOCIATION PIN

Due to the change in the name of the organization from *National* to *American* Association of Nurse Anesthetists made at the last annual meeting, the former pin is obsolete.

A new design is under consideration (see page 39 for announcement) and as soon as the new pin is available a notice will be inserted in the Bulletin.

AMERICAN ASSOCIATION OF NURSE ANESTHETISTS' COMMITTEES

1939–1940

Membership

Mrs. Theresa Hammond, Philadelphia, Pa. (Chairman)
Miss Della Logan, Camden, N. J.
Miss Lucy E. Richards, Cleveland, Ohio
Mrs. Lucile Goodman Kellogg, Cleveland, Ohio (as alternate)

Revisions

Miss Ruth Botsford, Rochester, N. Y. (Chairman)
Miss Cora McKay, Albany, N. Y.
Miss S. Louise FitzGerald, Rochester, N. Y.

Publication

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Miss Harriet L. Aberg, Plainfield, N. J.
Miss Rose G. Donovan, Philadelphia, Pa.
Miss Jewelle C. Fink, Memphis, Tenn.

Legislative

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Mrs. Mary J. Stevenson, San Francisco, Cal.
Miss Hazel Peterson, Minneapolis, Minn.
Miss Hattie Vickers, Nashville, Tenn.

Nominating

Miss Dorothy M. Hoadley, Ft. Worth, Texas (Chairman)
Miss Olive L. Berger, Baltimore, Md.
Mrs. Gertrude A. Troster, Memphis, Tenn.

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Mrs. Rosalie C. McDonald, Emory University, Ga. (Chairman)
Miss Mable E. Courtney, Detroit, Mich.
Miss Mary H. Muller, Durham, N. C.
Miss Esther Myers, New Orleans, La.

Education

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Sister Rudolpha, Springfield, Ill.
Agatha C. Hodgins, (Coronado Beach, Fla.), Chatham, Mass.
Miss Hazel Blanchard, Troy, N. Y.

Educational Correlating Committee

Miss Helen Lamb, St. Louis, Mo. (Chairman)
Mrs. Rosalie C. McDonald, Emory University, Ga.

Program and Convention Arrangements

Miss Gertrude M. Gerrard, Boston, Mass. (Chairman)

Finance

Mrs. Gertrude L. Fife, Cleveland, Ohio (Chairman)
Miss Marjorie H. Walker, Cleveland, Ohio
Miss Myrna E. Momeyer, Cleveland, Ohio
Miss Verna M. Rice, Mobile, Ala.

Trust Fund

Miss Verna M. Rice, Mobile, Ala. (Chairman)
Mrs. Ida T. Ellis, Orlando, Fla.
Mrs. Gertrude L. Fife, Cleveland, Ohio

Executive

Miss Miriam G. Shupp, Rochester, N. Y. (Chairman)
Sister M. Borromea, Peoria, Ill.
Mrs. Gertrude L. Fife, Cleveland, Ohio
Miss Louise Schwarting, Fort Dodge, Ia.

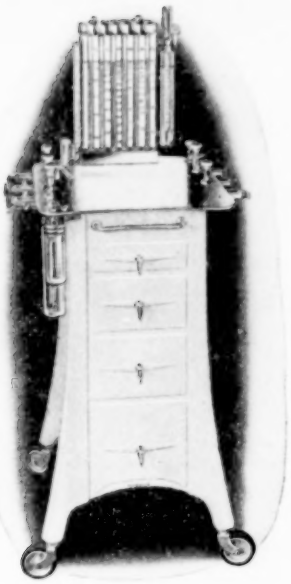
FORM OF BEQUEST OR CONTRIBUTION

In response to inquiries reaching the headquarters of the American Association of Nurse Anesthetists the following form is suggested as a proper one to follow:

"I give, devise and bequeath to the American Association of Nurse Anesthetists' Trust Fund the sum of.....
.....dollars, or property or holdings as follows:

All income from the Fund known as the American Association of Nurse Anesthetists' Trust Fund will be used for the aged and indigent nurse anesthetists who qualify for participation in the benefits of said fund as stated in Trust Fund Document.

Signed .....
(Address in full) .....
Date..... .....



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INCREASED VISIBILITY—no floats required as flow meters are outside of water container. 8½" between minimum and maximum readings on each scale, hence fine regulation possible without eye strain.

SIMPLICITY UNEQUALED—no moving parts, hence no mechanical adjustments required.

SAFETY—no static-generating friction at any point within apparatus or breathing circuit. Gases are mixed in water chamber before leaving apparatus proper, hence do not depend on patient's respiration for adequate humidity.

DURABILITY—rugged construction and greater endurance than even our old Gwathmey models which practically never wore out.

DEPENDABILITY—backed by over 25 years experience—first with individually calibrated flow meters—first to adopt metric system for easy computation of percentages—first practical carbon dioxide absorption apparatus—first cabinet apparatus.

NEW CATALOGS NOW AVAILABLE

THE FOREGGER COMPANY, INC.

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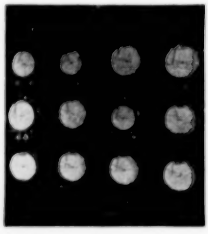
If you spend 86 years perfecting a process *you learn a lot about it*

For over three-quarters of a century the House of Squibb has been producing only one grade of ether—the best for anesthesia. It started in 1853 when Dr. Squibb, after making and discarding 20 stills, made his greatest contribution to anesthesia by successfully completing his process for the continuous steam distillation of ether.

We learned about stability

In the early days, Squibb Ether was packaged in glass bottles. When this proved unsatisfactory due to danger of breakage—tin was tried. Then it was found that pure ether developed aldehydes and peroxides when packaged in ordinary containers. Years of research resulted in the development of the patented copper-lined container which definitely prevents the formation of toxic substances. Squibb Ether is the only ether protected by a copper-lined container.



We set up rigid control standards

The standards set by the Squibb Laboratories in the selection of the raw materials used in making ether are important—but the secret of its uniformity lies in the elaborate control during manufacture. A control panel records a permanent chart of temperatures and specific gravity during production. Sensitive automatic devices control each important step in the manufacture—thus assuring the quality of Squibb Ether.

You can have confidence in Squibb Ether

The fact that Squibb Ether is used in over 85% of American hospitals and in millions of cases every year is an indication that surgeons and anesthetists have confidence in its purity, potency and safety—a confidence born of experience.

For literature write to Anesthetic Division, E. R. Squibb & Sons, 745 Fifth Ave., New York.

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You can place confidence

in **CHENEY** *Products*

Nitrous Oxide
Ethylene
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Carbondioxide—Oxygen Mixtures
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We still have available some of the monographs "Cyclopropane—A Study of the literature" Write for your copy.

Anesthetic Gas Machines & Replacement Parts

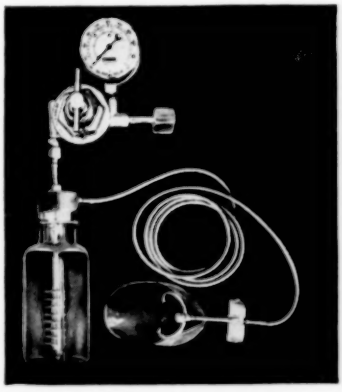
Equipment for Oxygen Administration

◆

An Addition to our Equipment for Oxygen Administration

The Improved Lombard Inhaler

1. It is efficient.
2. It is inexpensive.
3. It is comfortable.
4. It is compact and light.
5. It is simple to operate.



6. It has a hinged face piece enabling patient to take food and water without removing the inhaler.
7. This face piece is not costly. A new hood for each patient.

The Improved Lombard Inhaler is universal. It can be used on bed patients, office patients and ambulatory patients.

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